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PUBLICATIONS OF THE JOHNS HOPKINS UNIVERSITY.

I. **American Journal of Mathematics.** S. NEWCOMB, Editor, and T. CRAIG, Associate Editor. Quarterly. 4to. Volume IX in progress. $5 per volume.

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CALENDAR, 1885–86.

1885, Thursday, October 1.	Academic Year Began.
" Thursday, December 24—Saturday, January 2.	Christmas Recess.
1886, Monday, February 22.	Commemoration Day.
" Friday, April 23—Monday, April 26.	Spring Recess.
" Tuesday, June 15.	Term of Instruction Closes.

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[Issued, October 21, 1885.]

CHESAPEAKE ZOÖLOGICAL LABORATORY

MARINE STATION OF THE JOHNS HOPKINS UNIVERSITY

EIGHTH SESSION, BEAUFORT, N. C., 1885.

The marine laboratory of the university was opened at Beaufort, N. C., on May 23, and it was occupied for research until September 15.

As the party was much too large for the house which was used in past years, a second one, which was vacant for the summer, was rented and occupied, but even with this additional space, several applicants were refused, from lack of room.

The following is a list of the members of our party:

W. K. Brooks, Ph. D., *Associate Professor of Morphology, J. H. U.—Director.*
E. A. Andrews, Ph. B., *Fellow, J. H. U.*
A. T. Bruce, A. B., *Fellow by Courtesy, J. H. U.*
G. B. Haldeman, A. B., *Graduate Student, J. H. U.*
J. C. Hemmeter, M. D., *Graduate Student, J. H. U.*
F. H. Herrick, A. B., *Graduate Student, J. H. U.*
W. H. Howell, Ph. D., *Associate, J. H. U.*
O. P. Jenkins, A. B., *Terre Haute, Ind.*
T. W. Mills, M. D., *Lecturer on Physiology, McGill University, Montreal.*
J. P. McMurrich, Ph. D., *Instructor, J. H. U.*
A. D. Morrell, *Chapel Hill, O.*
H. F. Nachtrieb, S. B., *Prof. of Zoölogy, University of Minnesota.*

The following abstracts indicate the scope and character of the work which was carried on.

The Metamorphosis of Limulus polyphemus. By Prof. Henry L. Osborn, Purdue University, La Fayette, Indiana.

Explanatory note by W. K. Brooks. Prof. Osborn has kindly placed at my disposal the notes and drawings which he made at the marine laboratory at Beaufort in 1884 from the eggs of Limulus which he had procured from the oviducts and had fertilized artificially. He made a very careful study of the superficial changes in the egg, and the young larva, and cut sections through the eggs at a very early stage of their development, but as he did not study the later stages in the same way he failed to understand his sections, and I have, therefore, made a few slight changes in his notes, in order to bring them into harmony with the conclusions which have been reached by Mr. Bruce and myself in our study of the same subject this summer. W. K. Brooks.

Soon after fertilization the yolk contracts and shrinks away from the chorion, and a number of deep irregular fissures make their appearance running in towards the centre and cutting up the yolk into masses which resemble cleavage segments. The fissures are very irregular and present a great variety of forms. Some of the eggs remain almost perfectly smooth and round, while others become deeply furrowed, and nearly all of them pass through the furrowed stage, although I did not observe any in which there was a perfectly regular segmentation of the surface. The irregularity of these changes would seem to indicate that they are pathological, although they do not prevent the eggs from undergoing normal development, to its completion.

In from one to three days after fertilization the egg exhibits a structure which is the first indication of normal development. In surface view this structure resembles a circular pit or depression with a dark centre, surrounded by a circle of lighter color. My sections at this stage show that it is not a depression, but a protoplasmic cap, situated upon the surface of the yolk. It stains deeply; but is perfectly clear and transparent, and I could find in it no nucleus or trace of a cellular structure. It soon disappears and its relation to the future parts of the embryo was not determined.

The time at which this structure appears is very inconstant and there is also the greatest difference in the rate of development among the individual eggs, and some are much more tardy in arriving at the various stages and emerge from the shell a day or two later than the most rapidly developing ones.

During the night of the 26th (the eggs were fertilized July 23d) the pit disappeared, and at 8 a. m. on the 27th a white mound was observed upon the surface, at once recalling the *primitive cumulus* of Claparède and Balfour. It is very constantly present, but I do not know its relation to the future parts or to the pit which preceded it.

On July 28th, 11.30 a. m., a deep semicircular depression showed itself. On the 29th, in the space between the two lips of the depression of the day before, a pair of buds appears—the beginnings of the anterior pair of limbs. On the following day two more pairs are added, and in front of the first pair and behind the front lip of the fold, a most important structure is for the first time seen, it is a slit elongated antero-posteriorly; the definitive mouth opening. It is distinctly in front of the first pair of limbs. It is to be noted that the anal opening has not yet shown itself according to my observations. The stomodeum and the three somites are now included in an area which is plainly marked off from the rest of the egg and surrounded by an oval elevation. On the following day, July 31, there had appeared inside this rim the remaining pairs of cephalo thoracic appendages. On the 31st a thickening along the middle ventral line marked out the nervous system.

This lot of eggs was followed and the embryos all hatched in due course, though the circumstances in which they were placed were very unfavorable. Twenty healthy eggs were carried in a 4 oz. bottle inland and development went on normally, and on August 16, 24 days after fertilization, the first one of the lot hatched and the others all followed it, straggling along for several days. Others left at Beaufort hatched in due time.

Observations of the surface from the time that the limbs are marked off do not add anything to the facts described by Packard and Dohrn, except that the statement of Packard that the compound eyes appear upon the third segment is wrong. They appear very plainly upon the fourth somite as stated by Dohrn.

Abstract of Researches on the Embryology of Limulus polyphemus. By W. K. Brooks and A. T. Bruce.

Segmentation. At the end of the process of segmentation, sections show that the entire yolk of the large and totally opaque egg consists of an uniform mass of large spherical yolk cells, each with its nucleus. They are of uniform size from the centre to the surface, and are closely packed with yolk globules and granules, but they are not flattened by mutual pressure, since their outlines are nearly circular.

The changes which the egg undergoes in reaching this stage are very peculiar, but its total opacity prevents superficial examination, and as there are no external marks by which a series of eggs can be cut in the same place, it is difficult to form a complete picture of the course of segmentation, although the process appears to be as follows: —

In a ripe, unfertilized egg the yolk consists of a homogeneous mass of yolk globules and granules, covered at one point by a superficial aggregation or cap of protoplasm.

In sections of an egg twenty-four hours after fertilization, protoplasmic processes or pseudopodia extend from the cap into the yolk, and surrounding and including the substance of the yolk, divide this up into a number of *yolk-balls*, each of which consists of an investing sheath of protoplasm with an inclosed sphere of yolk, but they contain no nuclei, nor were any found at this stage in the protoplasmic cap.

On the third and fourth days after fertilization the *yolk-balls* are smaller and more numerous, with sharper outlines, and one or two large, sharply-defined oval nuclei were visible in the protoplasmic cap. On the fifth day this begins to decrease in size, and ultimately disappears, while the *yolk-balls* become more numerous, and a very small nucleus becomes visible in each of them. The yolk is so opaque and so packed with granules that we were unable to decide whether the nuclei are on the surface or in the interior of the yolk-balls, and we learned nothing regarding the origin of the nuclei.

The Origin of the Blastoderm. After segmentation is completed the cells nearest the surface become smaller than the central ones, probably as the result of cell division. These peripheral cells are at first rounded and filled with yolk, like the central ones, but they soon become transparent, flatten

against each other and form a columnar epithelium, one cell thick, over the whole surface of the egg, which is thus divided into a central yolk made up of large spherical cells filled with yolk, and a surface layer which may, for convenience, be called a blastoderm, although it gives rise only to the ectodermal and mesodermal organs of the embryo, while the yolk cells give rise to the endodermal epithelium of the intestine and liver, and also, in all probability, to part of the mesoderm.

As soon as the so-called blastoderm is formed it excretes from its outer surface the so-called *protoderm* or chitenous embryonic cuticle, which is marked by polygonal casts of the ends of the cells, from which it is soon separated and thrown off.

Origin of the Mesoderm. An area of the blastoderm now becomes many cells thick and forms the *primitive cumulus* noticed by Osborn. In sections it bears a close resemblance to a corresponding part of the spider's egg, as figured by Balfour. It is five or six cells thick at the centre, and gradually thins out until, at the edges, it is only one cell thick. Our sections do not enable us to decide whether it is formed by division of the blastoderm cells or by the addition of new cells from the central yolk, and it may possibly be derived in part from each of these sources.

The ventral nervous system arises as two parallel thickenings of the germinal area, separated from each other by a median ingrowth, which grows into the surface of the yolk, where it spreads out on each side to form the mesoderm, which appears to receive additions from the yolk cells. It soon splits on each side to form a splanchnic layer on the surface of the yolk, and a somatic layer which covers the nervous system and lines the surface epithelium. As the appendages grow out the somatic layer and cavity extend into them, but soon become obliterated in all parts of the body by the development of a network of mesodermal connective tissue corpuscles, as shown at the anterior end of the body in the figure.

The yolk at first forms a continuous mass of cells which almost fill the entire body of the embryo, but it soon becomes divided into yolk somites, by the development of paired mesodermal processes or dissepiments which grow upward from the ventral to the dorsal surface, from points just outside the bases of the limbs. The division of the yolk into somites which is so well shown in Packard's figures, is the effect of the growth of these processes, which give rise to the muscles of the limbs and ento-sternum, while the latter is itself formed by a thickening of the splanchnic mesoderm on the ventral surface of the yolk.

The Origin of the Digestive Tract. At the time when the first limb-buds appear the oral invagination also appears, between and a little in front of the first pair, although the mouth soon travels backwards, as shown in the figure. The oral invagination grows upwards and forwards, as shown in the figure, and its inner end bends back upon itself, and pushes in to the yolk. It consists of an epithelial lining which soon becomes thrown into longitudinal folds, or ridges, upon which a thick chitinous cuticle is developed; and of an investing sheath of mesoderm, which is derived from the somatic layer, and from the muscles of the œsophagus and stomach.

Our sections give the history of the endoderm with clearness which leaves little to be desired, and Limulus is remarkable for the fact that there are no endodermal structures whatever at the time of hatching. The limbs, muscles, heart, nervous system and sense organs of the newly-hatched Limulus are well developed, but so far as its endoderm is concerned it is not a larva but an embryo, and it lives a free active life and even undergoes one moult while its endoderm is in an embryonic condition.

The figure shows a median longitudinal section of an embryo just before hatching. There is no anus or rectum, the oral invagination is well advanced, and has essentially its adult form, but it ends blindly, and the intestine is represented by a solid mass, *k*, of yolk cells, flattened by pressure, and inclosed in a splanchnic layer of mesoderm, *l*, which is several cells thick along the ventral middle line, where it is to become the *ento*-sternum, but elsewhere it is only one cell thick.

As the figure shows, the intestinal region is sharply marked out in a median longitudinal section, but this is not true of transverse sections, for the yolk extends to the lateral edges of the carapace, when it is not interrupted by the muscular dissepiments, and it is not until some time after hatching that the lateral liver-lobes are cut off from the median intestine proper, by the growth of muscles from the sides of the ento-sternum to the dorsal surface.

In its origin the liver is part of the intestine, which is, morphologically speaking, a great flat pouch, reaching to the edges of the body, and imperfectly divided, by the growth of the muscles, into an axial intestine and two lateral hepatic pouches, each of which is again divided up into the liver tubes in the same way.

At the time of hatching both intestine and liver are solid and made up of yolk cells, inside a sheath of mesoderm. At the stage shown in the figure the yolk contains great numbers of nuclei, which are most abundant near the surface, where they are much more numerous than the yolk cells. A few days after hatching the cells themselves become smaller and more numerous, and arrange themselves in a single layer around a central space, which is formed by the absorption of the yolk. At first these cells are filled with yolk globules, like the yolk cells, which they resemble in everything except size, but after the first moult the yolk substance gradually disappears, from in front backwards, and the cells become converted into the ordinary epithelial lining of the intestine. The endodermal lining of the liver tubes is formed in the same way, but more slowly.

The anal invagination does not make its appearance until after the intestine is formed, and the rectum is very short.

The Nervous System. The ventral nerve cord originates as a pair of parallel thickenings of the blastoderm, which become free from in front backwards, and become divided up into ganglia with longitudinal and transverse commissures. The commissure between the ganglia of the first pair of appendages is *in front* of the mouth, and there is a distinct pair of ganglia for the seventh pair of appendages. The brain is formed, in part, from the anterior ends of the nerve cords, and in part from two independent ectodermal ingrowths.

The Eyes. Ray Lankester has recently shown that there is a fundamental difference in the structure of the lateral and the median eyes, inasmuch as the sensory cells of the former lie in and are part of the surrounding ectoderm, while the median eyes consist of a *vitreous body* formed from the ordinary ectoderm cells, and inside this, a retina which is distinct from the adjacent ectoderm. This structural difference corresponds to a fundamental difference in the origin of the two kinds of eyes. The lateral eyes originate, very early in the life of the embryo, by specialization of the ectoderm cells, while the sensory portion of the median eyes is invaginated from the ectoderm of the *ventral* surface, on the middle line, between the divergent optic lobes of the brain, as shown at *h* in the figure.

General Conclusions.—To the interesting question—what other embryonic history most closely resembles that of Limulus, there can at present be but one answer. So far as our present knowledge goes the embryonic history of Limulus finds its closest parallel in the embryology of the Arachnida.

In his paper on the development of spiders, Balfour gives the following summary of the points of difference from the crustacea. The mesoblast is formed by a thickening of the median line of the ventral plate, while in most crustacea it is budded off from the walls of an invagination which gives rise to the mesenteron. It becomes divided into somites, the lumen of which is continued into the limbs.

There is generally in the crustacea an invagination which gives rise to the mesenteron, and the proctodaeum is usually found before or not later than the stomodaeum, and both, especially the proctodaeum, are very long and usually give rise to the greater part of the alimentary tract, while the mesenteron is usually short. In the spider, as in the tracheata in general the mesenteron is very long, and the proctodaeum is always short, and is formed later than the stomodaeum.

In all these particulars Limulus agrees with the spider, and no one can compare Balfour's figures of the spider's egg with our sections, without noticing the striking resemblance in nearly every detail of structure. He failed to trace out the origin of the endoderm, but his figures and the description show that in this respect also there is, in all probability, the closest agreement with Limulus.

We have shown that the liver and intestine are, as regards their origin, parts of a large pouch, imperfectly separated by the fissures formed by mesodermal dissepiments, and that the endodermal epithelium of both is formed from the yolk cells, and Balfour says of the spider, that it would not be unwarrantable to conclude, from his observations, that the yolk compartments formed by the mesodermic septa are the hepatic cœca, each of which is enclosed in a layer of splanchnic mesoderm, while its endodermal wall is derived from the yolk cells, and that there can be very little doubt that the endoderm of the intestine owes its origin to cells derived from the yolk.

The figures which Balfour gives seems to leave little room to doubt this conclusion, and we therefore have another point of most striking resemblance to Limulus.

Observations upon the Chemical Composition and Coagulation of the Blood of Limulus polyphemus, Callinectes hastatus, and Cucumaria sp. By W. H. Howell.

The blood of Limulus polyphemus as it flows from the heart is at first of a milky white color, but soon changes on exposure to the air to a dirty bluish white. Almost immediately after escaping the blood begins to clot, though the coagulation is never so complete as to cause it to set into a solid mass. Sometimes the clot consists of isolated masses of fibrin which settle to the bottom, at other times it forms a more or less continuous mass, which gradually contracts forcing out the serum.

All efforts to prevent the coagulation by cooling with ice or saturation with neutral salts were unsuccessful. The serum obtained after removing the clot possesses a strong alkaline reaction and is of a deep blue color by transmitted light, becoming opaque whitish blue by reflected light.

Specimens of this serum neutralized with 1 per cent. acetic acid and heated in a double water bath, showed the presence of four distinct albumins, coagulating, respectively, at 58°-60° C., 68°-70° C., 74°-75° C., and 78°-80° C. The first three of these albumins are completely precipitated after being heated for five or ten minutes, but the last albumin shows the very remarkable peculiarity that the process of heating has to be repeated some fifteen or twenty times before the albumin is completely removed. Each time that the liquid is heated a well marked precipitate occurs, which does not appear to increase when the liquid is kept at 80° for even half an hour. The filtrate from this precipitate is perfectly clear, and, when heated again to 80°, gives an exactly similar precipitate, care being taken to keep the liquid neutral by the addition of a drop or two of 1 per cent. acetic acid after every one or two precipitations.

Efforts made to separate these albumins were not successful. The serum gives the following reactions with the neutral salts. Ammonium sulphate or sodium sulphate added to saturation completely precipitates all the albumins. Magnesium sulphate added to saturation gives a strong precipitate containing portions at least of all four albumins. The filtrate after this saturation could never be obtained perfectly clear. If serum was heated to 75° C., to get rid of the first three albumins, and then saturated with $MgSO_4$, a partial precipitation was still produced. Sodium chloride added to saturation precipitates partially the albumins coagulating at 68° C. and 75° C.

The clear blue serum when exposed to the air gives a flocculent precipitate containing portions of the albumins coagulating at 75° C. and 80° C. Serum diluted ten times with water gives a precipitate containing the albumins of 70° C. and 80° C. Passing CO_2 through the diluted serum does not increase the precipitate, and if the precipitate formed by dilution is filtered off, and the liquid then treated with CO_2 no further precipitation results. Serum dialysed through parchment paper gave a precipitate containing the albumins of 70° C. and 80° C. The water used for dialysis was rain water collected in a cistern, since distilled water could not be obtained. Neutralization of the serum with 1 per cent. acetic acid gave a small precipitate having a coagulating temperature of 80° C. When the serum was made distinctly acid with the acetic acid, 1 per cent., very nearly all of the albumin was precipitated in an insoluble form, the portion not precipitated being converted to acid albumin.

From a consideration of these reactions, it is plain that the albumins of limulus serum all bear a closer resemblance to paraglobulin, or, at least, to the globulin family, than to any other known form of albumin. Their precipitation by $MgSO_4$, dilution with water, dialysis, or simple exposure to air are all reactions that place them among the globulins.

Investigation of the blue coloring matter of the serum tended to support the view that it is a compound of copper with an albumin, similar, in a general way, to the compound of albumin and iron in haemoglobin. The color is associated chiefly with the albumin coagulating at 80° C. That the copper of the serum is united with the albumin was shown by the fact, that, when the albumins were precipitated by ammonium sulphate, no copper could be detected in the filtrate, while the precipitate after incineration gave plain evidence of its presence. The respiratory value of this compound is not very evident as far as the limulus is concerned. The blood in the heart and arteries does not possess a blue color; the blue serum does not change its color when treated with CO_2, and when hermetically sealed it disappears only after many hours. Examined with the spectroscope it shows no definite absorption bands: though a large portion of the blue end of the spectrum is cut off.

The coagulum of limulus blood is formed entirely from the union of the corpuscles. Shreds of freshly formed fibrin show this very plainly, and, when the process of coagulation is watched under the microscope, beautiful fibrin networks are seen to form, starting from the corpuscles. These networks are easily stained and resemble on a large scale the fibrin network described, for man and other mammals, as originating from the blood-discs. Details of this process must be left for a subsequent paper.

Chemical examination of the fibrin shows that it is practically identical with typical mammalian fibrin, although formed directly from the substance of the corpuscles. Treated with 10 per cent. $MgSO_4$ or NaCl solution for many hours, at a temperature of 35°-40° C., it is only slightly dissolved. Treated with 1 per cent. HCl it swells up but dissolves only to a slight extent. Treated with 1 per cent. NaOH it is easily soluble, the solution being percipitated when neutralized with 1 per cent. acetic acid.

The blood of the common edible crab of our coast, callinectes hastatus, was submitted to a series of experiments similar to those given for the blood of limulus. When shed, the blood coagulates with great rapidity, and this could not be prevented by the action of cold or neutral salts. The clot differs markedly from that of limulus blood in that it is much more firm, the blood setting into a solid mass. The serum separated from the clot is of a clear blue-green color that shows no opalescence by reflected light. It has a strong alkaline reaction. When carefully neutralized with 1 per cent. acetic acid and heated, the serum gives evidence of only two albumins, one coagulating at about 55° C., the other at 68°-70° C. The latter albumin shows the same peculiarity as that described for the albumin of limulus blood coagulating at 80° C., requiring some twenty or more different heatings before it is completely removed. In some specimens a minute quantity of the albumin required heating to 80° C.

Both albumins are completely precipitated by ammonium sulphate and also by magnesium sulphate. The precipitation by the latter salt is peculiar in that the filtrate from the precipitate first formed, at first clear, soon deposits a new precipitate, and this is repeated a third time. Saturation of the serum with sodium chloride throws down part of the albumin coagulating at 70° C.

Simple dilution of the crab's serum does not cause a precipitate, unless the serum is first neutralized. CO_2 when passed through the serum soon decolorizes it, the color reappearing when shaken with air. If the serum is first diluted a precipitate is formed by the CO_2.

The clot formed from the crab's blood is also made directly by the union of the corpuscles. This is not so evident as in the limulus blood, but in

specimens allowed to clot under the microscope, and then stained, the process can be clearly seen. The corpuscles send out long and very delicate processes which form a close network binding the corpuscles together.

The fibrin of crab's blood is much more soluble in solutions of neutral salt than that of limulus blood. It is partially soluble in solution of common salt containing from two to ten per cent. of the salt. The solution of the fibrin in 2 per cent. NaCl coagulates at 71°-72° C. Hydrochloric acid 1 per cent. swells up the fibrin but dissolves it only to a slight extent. Caustic soda 1 per cent. readily dissolves the fibrin.

The liquid of the perivisceral cavity and water-vascular system of one of our common holothurians possesses only one albumin, viz., the haemoglobin contained in the red blood corpuscles. Specimens of the perivisceral liquid allowed to stand in watch crystals give an imperfect coagulum, the corpuscles settling to the bottom as a membranous-like sediment. The supernatant liquid contains no albumin at all. The imperfect coagulation is formed by the fusion of the amœboid white corpuscles or of thick pseudopodia which arise from them. The red corpuscles exhibit no tendency to adhere to one another, though they become entrapped in the masses of fused white corpuscles.

The study of the coagulation of the blood of these three invertebrates, taken together with the work that has been done on other forms, seems to indicate that amongst the invertebrates generally any coagulation that may occur is caused by the direct union of corpuscular elements. The work of the last few years upon the coagulation of mammalian blood shows that here too the fibrin is apparently formed directly from one kind of corpuscle, the so-called blood-discs. The striking resemblance in the method of union of the corpuscles to form the clot, in mammalian blood and the blood of limulus, for instance, and the close similarity in chemical properties of the fibrin produced, suggest that the formation of fibrin in the two cases may result from an essentially similar series of changes.

The Presence of Haemoglobin in the Echinoderms. By W. H. Howell.

Haemoglobin has been found in the blood of certain species of several of the divisions of the invertebrates, *e. g.*, annelids, insects, molluscs, but up to the present time no satisfactory example of its presence among the Echinoderms has been discovered. Foettinger described in one of the ophiurians, ophiactes virens, certain red corpuscles contained in the water vascular system which, upon examination with the micro-spectroscope, gave two absorption bands similar to those of oxy-haemoglobin; from this he concluded that the coloring matter of these corpuscles is haemoglobin. But other pigments, turacin, for instance, are known to give very similar if not identical bands, so that this single observation can not be considered as demonstrating the presence of haemoglobin.

During the summer's work at the marine laboratory, the writer's attention was directed by Mr. H. F. Nachtrieb to a holothurian, whose perivisceral liquid is in some cases of a bright red color. Examination of this liquid and of the contents of the water-vascular system showed that the coloring matter has most of the properties of haemoglobin, though certain differences in its chemical reactions have led me to believe that it is not identical with the haemoglobin of vertebrate blood.

The water-vascular system and the body cavity contain, besides colorless amœboid corpuscles, a large number of oval, nucleated, bi-convex blood discs of a pale red color. When a specimen of this water-vascular liquid is caught in a watch crystal, these corpuscles soon settle to the bottom, forming a membranous-like sediment. If the supernatant liquid is decanted, and the sediment treated with water and then filtered, a beautiful blood-red solution is obtained. This solution when examined with the spectroscope gives the two oxy-haemoglobin bands; the wave length of the middle of each band was determined, and was found to be identical with that of the corresponding band of a solution of oxy-haemoglobin of human blood of the same strength. Addition of Stokes' reducing solution causes the two bands to disappear, and brings out the single band of reduced haemoglobin. By shaking the solution with air the two oxy-haemoglobin bands can again be obtained. The corpuscles when treated with glacial acetic acid and salt give well marked haemin crystals, though these crystals do not form so readily as with vertebrate blood. When incinerated and tested with ferrocyanide of potassium they give the reaction for iron.

These properties are quite sufficient to show that this coloring matter is a compound similar to ordinary haemoglobin, and justify its right to the title of haemoglobin. In two respects, however, it differs from the haemoglobin of vertebrate blood. An aqueous solution when heated coagulates at 58°–60° C., giving a heavy brown precipitate, the filtrate from which is perfectly free from albumin. Haemoglobin solution from vertebrate blood, on the other hand, coagulates between 70°–80° C. A solution of this haemoglobin is also precipitated by the addition of dilute, 1 per cent. acetic acid, which is not true of vertebrate haemoglobin.

It appears then that we have here a compound similar in structure and in some of its most essential properties to the haemoglobin of vertebrate blood, but differing from it slightly in the albuminous portion of the molecule. It seems quite possible that similar differences may be found when the haemoglobin of other invertebrates is more carefully examined. All efforts to obtain haemoglobin crystals were unsuccessful.

The respiratory value of this pigment cannot be doubted. It performs its functions not only through the ambulacral feet scattered over the surface of the body, but also through the respiratory tree, the ramifications of which are bathed in the perivisceral liquid. The respirations of the animal when undisturbed are very regular, consisting usually of three inspirations followed by a single prolonged expiration, the whole respiratory act being repeated from three to four times a minute. Efforts to increase the respiratory rhythm by heating the sea water surrounding the animal were not successful.

On the Existence of a Post-oral Band of Cilia in Gasteropod Veligers. By J. Playfair McMurrich.

The question as to the phylogeny of the Mollusca is as yet undecided, though recent researches indicate a relationship between this group and that of the Annelida. The discovery of the peculiar forms *Neomenia*, *Proneomenia*, and *Chætoderma*, gave a strong impulse to this idea on account of their similarity in some respects to what obtains in the *Polyplacophora*, but it is not safe to argue a direct descent from these forms, or even to imagine that they come into the ancestral line at all. It is quite possible that they and the *Polyplacophora* are offshoots from the direct stem, and probably we must look more to the embryological history of the Gasteropods for light on the subject. Attempts have been made, notably by Hatschek (*Studien ü. Entwickelungsgesch. d. Anneliden*, *Wien*, 1878), to trace a relationship between the Polygordius larva of the Annelida and the Molluscan larva, and thus to throw any relationship which may exist between the two groups back to a very early period in their evolution.

If it can be shown that there is considerable similarity between the larvæ of the two groups, and if the differences which do exist can be explained as adaptations to new conditions, the presumption as to the genetic relations between the larvæ will be greatly strengthened. As regards the arrangement of the cilia, which is the only point to be dealt with in this note, we have in the Polygordius larva a strong præoral locomotive band, a more delicate postoral nutritive band, and a still less apparent ciliated region lying between these two bands and leading into the ciliated mouth. The identity of the cilia of the velum of the Gasteropod larva with the first of these, has been frequently noticed; they form a strong præoral band, occasionally double, and differing from the band of the Polygordius larva only in the extent of its development, and in its incomplete closure in many cases dorsally. This latter point of difference does not, however, hold throughout; the former may be explained by the necessity for a more powerful locomotive apparatus than is required for the Annelida, caused by the presence of a shell, a structure which appears very early in the life-history of the Mollusca. A postoral band has never as yet been described for the Prosobranchs. Several observers have called attention to the presence of a single band of cilia behind the cilia of the velum, and have regarded it as nutritive in function, and the object of this note is to call attention to the fact that this band passes across the ventral surface of the larva behind the mouth, and is, therefore, quite comparable to the postoral band of the Trochophore. My attention was first called to this fact in the larvæ of *Crepidula fornicata*, and I was afterwards able to confirm it in those of *Fulgur carica*, in a species of *Neptunea*, in two Prosobranch Veligers as yet undetermined, and in the

Opisthobranch *Montaguia* sp.? In the undetermined Veligers the velum was produced into four long flattened arms, round the margins of which were the strong locomotor cilia. On the under surface of the arms, running parallel to and not very remote from the locomotor cilia, was the finer band of nutritive cilia, the transparency of the arms and their size rendering it very apparent, and it could without much difficulty be traced across the ventral surface of the body immediately behind the mouth. Dr. W. K. Brooks informs me that he noticed the existence of this postoral band some time ago, and was then inclined to attribute some phylogenetic importance to it, but being occupied with other investigations he did not follow up his observations, and refrained from publication. Haddon also has described and figured it for certain Opisthobranchs, but does not seem to have observed it in the Prosobranchs he studied.

The region between these two bands is occupied by numerous very fine cilia, which, as in the Polygordius larva, are continuous with those lining the mouth opening and the œsophagus. The arrangement of cilia which is to be found in the typical Annelid larva is therefore almost exactly reproduced in the Gasteropod Veliger.

Arguing from ontogeny, a phylogenetic history of the Gasteropods somewhat as follows may be constructed. They and the Annelida have had their origin in a Trochophore. In the Gasteropods this ancestor developed a a univalve shell, represented by the larval shell so often replaced as development proceeds by another more highly ornamented and more complicated in structure. The development of this shell, by increasing the specific gravity of the animal, rendered the simple præoral cilia of the Trochophore insufficient for active locomotion, and the extent of the band was increased by the region of the body on which it occurred being as it were pulled out laterally, the characteristic velum being thus produced. Perhaps, too, in the presence of the shell, a reason can be found for the absence of metameric segmentation in the Gasteropods.

The Rhythm and Innervation of the Heart of the Sea Turtle.

By T. Wesley Mills, Lecturer on Physiology, McGill University, Montreal, Canada.

This investigation was undertaken partly as a continuation of previous work on the sea turtle, a short account of which had already been published in the *Journal of Physiology*, but chiefly as a continuation of my work on Chelonian heart physiology in general. A paper of mine, on the terrapin's heart, has recently appeared in Nos. 4 and 5, Vol. VI, of the journal referred to; but the whole of my work on the Chelonians is intended to furnish a systematic comparison from a physiological point of view of several of the genera and species of the Chelonians. It is thought no such systematic comparison has ever before been attempted for physiology, though it is constantly being done in morphology.

The investigation on the terrapin was carried on in the Biological Laboratory at Baltimore; those on the sea turtle, alligator and fish, at the Marine Laboratory at Beaufort, N. C. Only a very brief account of this work is furnished here, the papers *in extenso* having been sent for publication in the *Journal of Physiology* of Cambridge, England, in which also due acknowledgment is made of my indebtedness to the authorities and teachers of the Johns Hopkins University for facilitating these investigations.

In all of them the direct method of observation has been used and the heart has been experimented upon mostly *in situ*. For electric stimulation a Du Bois induction coil, fed by one Daniell's cell has been used, except in the case of one set of experiments on the alligator, in which a Bunsen's cell was substituted.

In order to insure the specimens of the sea turtle used being in the best possible condition, those not used at once on being caught were kept on the sea shore in a "turtle pen," so arranged as to admit of free ingress and egress of water. They were also fed on crabs, their natural diet. In all 20 specimens were employed, and of three species *Chelonia Caretta* (Loggerhead), *Chelonia imbricata* (Hawksbill), *Chelonia Midas* (Green Turtle). By way of comparison experiments have also been made on a limited number of specimens of the land tortoise (pyxis).

The Sympathetic System of Nerves in the Marine Turtles. It is very remarkable that *Chelonia Midas* in its cervical and thoracic sympathetic should very closely resemble the terrapin, but differ widely from *C. Caretta* and *Imbricata*. In the latter the sympathetic in the neck runs widely apart from the vagus and almost equals it in size. Its superior and middle cervical ganglia are ill-defined cordiform swellings, while the lower cervical and the first thoracic ganglia are fused together to form the *Ganglion cardiacum basale*. The latter is very large and gives off upwards many strong branches to the Brachial plexus, and downward to the lungs, etc., and probably to the heart.

From the middle cerv. gang. a strong branch passes to the heart along the vagus. This is a cardiac accelerator. The corresponding branch in the terrapin is much less defined and often wholly wanting.

Chelonia Midas differs greatly from *C. Caretta* and *Imbricati*, resembling very closely in its sympathetic system the terrapin. The sympathetic in the neck is very much smaller than the vagus, its ganglia well marked and it is often more or less united (though easily separable), with the vagus. But a great difference is the absence of fusion of the lower cerv. gang. and the first thoracic. These ganglia are in the terrapin often connected by an Annulus Vieussenii.

Sympathetic Cardiac Accelerators. Stimulation of the branch from the middle cervical ganglia referred to above leads in the sea turtle with greater constancy than in the terrapin to acceleration of the rate, and especially augmentation of the force of the beat of the heart. Also stimulation of the gang. card. basal. or the main chain between it and the first associated metamere below leads to acceleration and augmentation. The same laws apply to this as to vagus acceleration.

The Results of the Stimulation of the Vagus. The vagus when stimulated may arrest the auricle and ventricle in the manner described for the alligator. In no Chelonian thus far examined is the heart arrested by the vagus through the reduction of the force of the beat to zero, as in the frog. As in the terrapin *unilateral* vagus effects are comparatively common, *i. e.*, a strength of current sufficing to arrest one auricle, for example, when the corresponding vagus is stimulated, has much less effect on its fellow.

Comparative Effect of each Vagus. A large number of experiments have given results very closely resembling those obtained for the terrapin *i. e.*, in the great majority of instances the R. vagus has greater power, especially in *maintaining* the heart in stand-still or continued stimulation, than the left, but in both terrapin and sea turtle this difference appears to be less than in the land tortoise. This difference in the vagi seems to extend to other families of cold-blooded animals, and is to be explained not by a difference in the number of inhibitory fibres in each vagus, nor to inequality in the distribution of them, but to the fact that the right pulsatile venous area (R. sinus and veins), to which the R. vagus is mostly distributed, is the chief or *dominating* part in the driving machinery of the heart, for arrest of the heart is practically dependent on arrest of the sinus. In one case, in the sea turtle *prolonged alternate stimulation of the vagi gave perfect cardiac inhibition for more than six hours.* This is the longest case of heart stand-still of this kind yet recorded for any animal.

Structure of the Chelonian Heart. Between the sinus and the conspicuous auricle there is a part of the heart somewhat different in appearance, structure, and physiological qualities from either the sinus or auricle proper. A similar structure is found in some fishes. Especially have my experiments shown that the capacity for independent rhythm in this part is greater than in the so-called "bulged" part (Gaskell), of the auricles, I have therefore thought it well to name this part *sinus extension* and consider it a separate part of the heart. It is in reality more allied functionally to the sinus than to the auricle proper.

Very frequently in the Chelonians and especially in the marine turtles, stimulation of the vagus with a weak current suffices to arrest the auricles proper; in that case the contraction wave of the sinus is conducted along the sinus extension to the ventricle. The same occurs in the alligator and the fish.

The Law of Inverse Proportion. My work on the various genera of Chelonians and the alligator have shown conclusively that whether the vagus or the sympathetic cause the cardiac acceleration and augmentation, one law *invariably* applies, viz: *That the increase in the rate and force of the heart-beat after stimulation of the vagus or accelerating sympathetic, is always inversely as the rate and force at the time of stimulation*, i. e., the slower and weaker the heart, the greater the increase. The vagus seems to be the most constant and powerful cardiac augmentor known to us.

Faradisation of the heart directly has given for the sea turtle results analagous to those obtained in other Chelonians and the fish, but in the sea turtle there seems to be less effect, especially as regards dilation around the area stimulated.

The fact that arrest of the sinus by direct stimulation is not possible when the heart nutrition has much suffered (and especially, therefore, its nerves), and that the dilating effects are like those produced by vagus stimulation, &c., favors the view that the results of faradisation are not due to direct stimulation of the heart muscle but accomplished mediately through its nerves. The light colored areas, which I have pointed out are seen in all cases at the exact points of contact of the electrodes, are due to direct effects on the muscle (contraction).

Spontaneous Rhythm. The order in which spontaneous R. most readily arises and is best maintained is: sinus, S. extension, auricle, ventricle. A large number of experiments on the ventricle expressly, of the sea turtle, show that in the latter, as in all other Chelonians thus far examined, the V. has in most cases a certain capacity for independent R., but that apart from all forms of stimulation this R. is never very marked, though it may last for hours. This seems to be greater in the land tortoises than in other Chelonians.

The ventricle of the sea turtle is characterized by great *sensitiveness* as compared with that of other Chelonians, hence its spontaneous R. may be greatly increased by slight stimulation. Results, like those of Gaskell, obtained by suspending the heart, attaching recording levers and feeding it through its own system of vessels, without regard to the normal blood pressure therein, must not be considered as those of pure *spontaneous* rhythm, for such methods furnish stimulation. In my experiments the heart was kept surrounded with nutriment and covered so as to provide a "moist chamber," but it remained *in situ*. The V. was separated by ligature in most cases, by section in a very few.

Is there a Depressor Nerve in the Chelonians? Blood pressure experiments on the terrapin and the sea turtle have shown that no nerve with the characters of a physiological depressor exists in this family. Certain fine nerves in the neck of the sea turtle have on stimulation given results of a peculiar and puzzling kind. They have been inconstant in action, sometimes giving rise to acceleration, sometimes to retardation of the cardiac rhythm, or to both—now one, and now the other.

Stimulation of the Cerebral end of one Vagus, the medulla and other vagus being intact, in all the Chelonians I have examined, has usually produced cardiac arrest. In the sea turtle, in one case, this was followed by decided after-acceleration, but the different genera of Chelonians and even different species and individuals show variation in this respect, as also in the degree to which the heart can be reflexly inhibited; the terrapin and C. Midas resembling each other most and giving the best marked results. In fact this research has confirmed the truth of the law that with anatomical resemblances are usually associated physiological ones.

Evolution of Function. The experiments on the sea turtle have shown that where the cardiac nutrition suffers considerably, the L. auricle may even be quiescent when the right is still beating well; also that the ventricle dies in a certain segmental order, the last part to get rigid being on its right side; thus for some time before death an earlier condition (from a developmental point of view) is established, viz: Reduction to sinus, one auricle and a simplified ventricle. It is thus seen that the order of death for the different parts of the heart indicates its history, *the oldest parts have greatest vitality.* Further, the greater size and importance of the R. (part of the) sinus, of the R. auricle, &c., have also a relation to the order of acquisition. In the only fishes having an L. auricle, the Dipnoï, this part is very small and insignificant as compared with the right.

Anomalous Results. Stimulation of the liver in certain cases in the sea turtle, when reflex inhibition was being studied, has given results analagous to those obtained in the alligator, and especially in the fish, *i. e.*, the effect has not been pure inhibition, but preliminary acceleration with or without after-retardation. The subject is of great interest though very puzzling in the present state of knowledge. It is further considered in the account of the investigation on the alligator.

On the Physiology of the Heart of the Alligator.

By T. Wesley Mills.

The animals experimented upon belonged to the species *Alligator Mississippiensis.* The heart in the *Crocodilia,* with its two auricles and paired ventricles, though showing much resemblance to lower forms and retaining the pulsatile sinus venosus, both in its general appearance and in its action, approximates sufficiently to that of the higher vertebrates to suggest on superficial examination the heart of a mammal or bird (with slower action). The blood, too, is more highly oxidized than in the Chelonians, so that altogether the circulatory system shows physiological as well as anatomical advance. With the exception of Gaskell's short paper on the crocodile, (*Journal of Physiology,* Vol. V., No. 1), nothing has been published on the heart physiology of this group of animals.

The work of the present writer, while it confirms Gaskell's conclusions as regards the cardiac accelerator, is wholly at variance with his views as to the functions of the vagus. The vagus in the *Crocodilia,* at least in the alligator, is not a pure cardial depressor, but is on the contrary a powerful cardiac augmentor.

The results of the stimulation of the vagus may be thus stated:

(1.) Stimulation of the vagus with a weak, interrupted current may weaken the cardiac beat with or without arrest of the auricles; the latter may be arrested and give rise to a brief stop of the ventricles.

(2.) With a stronger current the sinus may be so weakened as to lead to arrest of the auricles and ventricles; or the sinus may be arrested wholly, in which case the auricles and ventricles invariably cease to beat.

(3.) When the cardiac beat recommences it may be in the order, sinus, sinus extension, ventricles; or, sinus, auricles, S. extension, ventricles, *i. e.*, the auricles may remain quiescent as in the Chelonians and fishes when all the rest of the heart is beating.

(4.) The rhythm after vagus stand-still may be (*a*) without acceleration, or (*b*) accelerated.

The augmentation in the force of the beat is more marked than acceleration in the rate. Both rate and force follow, as in the Chelonians, the law of *inverse proportion.*

Comparison of the Vagi and Results of their Prolonged Alternate Stimulation. The vagi in the alligator, as in the Chelonians, have not as a rule equal power in causing and *maintaining* cardiac inhibition; the right as in the other cold blooded animals examined being more effective. Prolonged stimulation of the vagi alternately leads to corresponding lengthened cardiac arrest.

Accessory Vagi. Certain small nerves are in the alligator given off from the Glossopharyngeal shortly after its exit from the skull, proceed downwards, apart from the vagus, and pass beneath the trachea over the vessels to the heart.

Stimulation of these nerves has led to similar results to those furnished by stimulation of the vagus, *i. e.*, retardation of the rate, weakening of the beat and after acceleration. Hence they have been called by me *accessory vagi.* There seem to be nerves of somewhat similar function in the sea turtle.

Peculiar Cardiac Inhibition followed by Acceleration. Special attention is called to the following experiment which is believed to be *unique* in physiology. In a small alligator with the *whole brain destroyed* for some time, *both vagi divided* and dead throughout the greater part of their course (stimulation not producing cardiac arrest), a sharp tap over the liver and stomach with a dissecting forceps caused cardiac arrest of brief duration, then slowed irregular rhythm followed by acceleration of a very pronounced kind (from 40 to 50 beats). Here then were the usual phenomena of reflex vagus inhibition, as when the vagi and medulla are intact. *This experiment was repeated three times.* It does not seem possible to explain this unparalleled result by present theories. I conclude that the impulses passed through the sympathetic system of nerves and that probably other inhibitory fibres than those of the vagus were concerned, and that accelerating fibres were also involved. It is also possible to conceive that terminations of the vagi were in some way reached by these impulses, but in any case the results are new to physiology, the only published case at all resembling it being Marshall Hall's experiment on the eel's stomach (*Todd's Cyclopedia of Anat. and Phys.,* article "Heart.")

Cardiac Augmentors. As described by Gaskell there is in the *Crocodilia,* from the Ganglion of the eleventh metamere of the sympathetic chain, a strong well-defined branch passing to the heart.

Stimulation of this nerve has given rise to (1) acceleration following the law of *inverse proportion,* which seems applicable to all kinds of acceleration. (2.) Decided augmentation of the force of the beat. This is more marked than the acceleration in rate, and in fact may disguise the effects of the nerve, for no actual acceleration of beat may follow.

In all cases stimulation of a genuine cardiac augmentor causes *increase in the work* done by the heart, hence these nerves should be called augmentors rather than accelerators.

Application of the Rapidly Interrupted Current to the Heart itself. In addition to the white dots seen at the points of application of the electrodes and the dilation and blue appearance following the use of a weak or moderate current, another effect noticed in the alligator, on the use of a very strong current deserves mention. From the part where the electrodes touched the auricle a considerable area took on a pale, even whitish aspect and seemed to diminish in size; by gradually moving the electrodes along, more and more of the auricle passed into the same condition. The part involved was thrown out of action, as in the case of the dilated portion. This condition seemed to be one of pronounced contraction, probably tetanic, and confirms the view that the white dots seen in all cases just where the electrodes touch are caused by contraction of the muscle fibres.

The Cardiac Rhythm of Fishes and the Action on the same of certain Drugs and Poisons. By T. Wesley Mills.

The object of the investigation was (1) to ascertain whether there were considerable physiological differences in the hearts of different fishes, and (2) to ascertain the laws regulating the rhythm of some one fish heart specially suitable for investigation, and (3) to determine the action of certain drugs and poisons on the fish's heart; these being, many of them, such as have been studied in their influence on the heart of the frog.

In general it may be said that the hearts of fishes are so sensitive to changes in normal conditions, and that most fishes are so easily killed, that it is not possible to pursue prolonged investigations on their hearts *in situ*. This remark applies especially to the Selachians whose hearts, from many points of view are exceedingly interesting.

Batrachus Tau (toadfish), is a fish of great vitality, resisting unfavorable conditions admirably, and its heart has a corresponding vital resistance, and being excellently suited for experimentation, this fish was the subject of a majority of the experiments of this investigation. Most of the work was done on the heart *in situ*, but the isolated heart was also studied. For the former experiments the fish was kept on its dorsal surface in a dish of water, the latter reaching sufficiently high to cover the gills but not flow over the exposed heart. The respirating centre was left intact. Under these circumstances the heart may be maintained fairly normal for several hours.

Considerable differences in physiological behavior have been found in the hearts of fishes, some of which will be noticed under different headings in this synopsis.

The Structure and Action of the Fish's Heart. In the Selachians, as examined by the present writer in the shark and skate, the heart consists of a *Conus arteriosus*, in addition to the sinus, auricle and ventricle. This structure is pulsatile and seems to be the most sensitive part of the whole heart.

The corresponding *Bulbus arteriosus* of other fishes is highly elastic but not pulsatile.

In observing such a heart as that of *Batrachus* during systole of the ventricle, the longitudinal and transverse diameters of the latter are seen to be shortened and the antero-posterior lengthened. It is seen that the apex ascends and the bulbus descends.

In the Selachians the beat is more highly peristaltic than in the hearts of other fishes, and in the former a reversal of the order of pulsation for the different parts is most easily originated and maintained.

In some fishes, as in the eel (McWilliam) and *Batrachus*, there is a part of the heart intermediate between the sinus and the auricle proper, as to appearance, structure, and functions; and, as it is in most respects physiologically like a corresponding part in the Chelonians, has been named by me sinus extension in both fishes and Chelonians ("basal" wall, and "flattened" portion of Gaskell, "Canalis Auricularis" of McWilliam). This part of the heart is often under peculiar circumstances in action when the auricle proper is quiescent, and then serves to conduct the wave of contraction on from the sinus to the ventricle.

Influences Affecting the Natural Rhythm of the Heart. Among these, in addition to mechanical excitation inducing a reversed rhythm already referred to, must be especially mentioned the condition of the blood supplying the heart as to degree of oxidation. Blood poor in oxygen, with greater readiness than in other cold-blooded animals, causes irregularity or arrest of the heart in the fish.

Faradisation of the heart in the fish leads to results very closely allied to those obtained in the Chelonians.

Reflex Cardiac Inhibition. The ease with which the heart of the fish can be reflexly inhibited by the stimulation of various parts of its body is one of the most remarkable facts brought out by investigation on the heart physiology of this animal.

The results are much the same whether mechanical or electrical stimulation with the rapidly interrupted current be employed. The parts that have been found most effective in *Batrachus* are the gills, the air bladder, the abdominal viscera, the mucous lining of the mouth, the tentacular appendages of the mouth, the pectoral fins, the anus and the tail.

The results may be either (1) decided arrest of the heart for several seconds, followed by a slowed rhythm, or (2) brief arrest with slowed and irregular rhythm or (3) the latter lasting from one to two minutes or longer without any actual stop of the heart. In some cases the operative procedure necessary to expose the heart is sufficient stimulus to keep the heart long inhibited. *The after results of inhibition* are not uniform. In some cases no acceleration seems to follow, but in others and the majority there is decided acceleration of the rhythm.

Peculiar Results associated with Reflex Cardiac Inhibition. Stimulation of several of the parts mentioned above, and especially of the anus and tail, have given the following remarkable results:

(1.) At first an accelerated rhythm followed by a slowed rhythm, or

(2.) An accelerated rhythm followed by a slowed rhythm on increasing the current, or

(3.) Only an accelerated rhythm.

This subject is further treated in the account of the turtle and alligator above.

It should be noted that in the *skate*, stimulation along certain lines on the ventral surface of the fish, apparently the course of mucous glands and likely associated with special sensitive structures, has produced remarkably good cardiac inhibition, and the results have been constant. The mucous membrane of the mouth is also, in the skate, a part giving decided results.

Independent Rhythm of Various Parts of the Heart. A large number of experiments on both the isolated heart and the heart *in situ* have brought out the following facts:

(1.) There is very great variety in the hearts of different fishes as to capacity for independent rhythm; between such fishes as the skate, the shark, and the toadfish (*Batrachus*) this difference is enormous.

(2.) In *Batrachus* every part of the heart is capable of good, independent rhythm; even the apex of the heart when isolated has shown such.

(3.) The order of the parts of the heart with greatest independent rhythmic power is—sinus, sinus extension, auricle, ventricle.

(4.) The independent rhythm of the ventricle *begins* soon after its separation from the rest of the heart (by ligature), speedily reaches a maximum and gradually declines.

The Action of Certain Drugs and Poisons on the Heart. Experiments have been made on the heart *in situ* and the results confirmed on the isolated heart. The agent was in each case applied in solution directly to the heart itself. The results are below stated very briefly.

Pilocarpin and *Atropin* in one per cent. solution. (1) These agents are antagonistic in action. (2) Pilocarpin is a cardiac depressant; atropin an excitant; the former lowers cardiac excitability; the latter most decidedly heightens it; the former weakens the beat and tends to arrest the heart in diastole, the latter calls into action the resources of the heart quickly and fully.

Sodium and *Potassium Carbonate* in five per cent. solution. These agents are antagonistic in action. Sodium carbonate is a cardiac excitant, potassium carbonate a depressant. The former tends to quicken the beats and diminish diastole. A heart arrested in diastole by potassium carbonate may be excited to action by sodium carbonate. Potassium carbonate must be regarded as a cardiac poison.

Lactic Acid. (1) In five per cent. solution this is a rapid cardiac poison. (2) In one per cent. solution its action is slower but it proves a decided depressant and the heart arrested by lactic acid cannot be excited to action by digitalis, sodium carbonate, &c.

Nicotin in one per cent. solution. (1) Its first action was often to arrest the heart in diastole. (2) This was sometimes followed by an irregular slowed rhythm giving way to a more rapid but weaker heart beat. But the fish heart shows great power of resistance against the effect of nicotin in weak solution and can, it would seem, recover almost wholly from the effect of this poison. Nicotin tends strongly to produce incoördination of the beat.

Chloroform (undiluted) acts as a decided cardiac depressant, tending to arrest the heart in diastole. The heart can, however, recover fairly well from a considerable quantity of this poison applied directly to it.

Acetate of Strychnia in one per cent. solution. This poison did not seem to have the most pronounced action, but *tended* to strengthen the systole, diminish diastole and arrest the heart in systole.

Veratria in rather less than one per cent. solution. The most distinct action is on the diastole, which it retards. The heart in action has a generally sluggish movement rather than a weakened one; the systole may in fact be slightly improved. It also tends to cause arhythmic phenomena —want of harmony in the sequence of the beats of different parts and of different fibres in the same part, *e. g.*, there may be two or more beats of the auricle for one of the ventricle, &c., or one part of the ventricle may be pulsating out of harmony with the rest.

Digitalin in somewhat less than one per cent. solution. This has more than any other of the agents tested a *constant*, decided and well defined action. (1) A short time elapses before its action is manifested; but when this begins it quickly and steadily rises to a maximum. (2) It causes diminished diastolic relaxation; but especially characteristic is the effect on the systole which is both more perfect and when complete more prolonged than usual. (3) The ventricle is always arrested in most pronounced (tetanic?) systole and then always looks very small and pale. It is inexcitable.

The action of drugs on such sensitive hearts as those of the Selachians was found correspondingly rapid. The action on the isolated heart was also more rapid than in the heart *in situ*, as was to be expected.

In many cases the first effect of a drug was to arrest the auricle proper leaving the sinus extension comparatively unaffected.

Origin of the Endoderm in Lepidoptera.

By A. T. Bruce.

A tolerably complete series of sections of Thyridopteryx at different stages of development, prepared at the biological laboratory of the University, has thrown considerable light on the embryology of the Lepidoptera.

In the earliest stages studied, the eggs were already segmented, consisting of a superficial blastoderm of flattened roughly hexagonal cells enclosing a segmented yolk. The central or yolk cells have large granular nuclei scantily invested with protoplasm which, sending out long filaments, encloses a number of yolk spherules, consequently each yolk cell is a centre of attraction to the spherules surrounding it. It is the adhesion of these spherules to the peripheral filaments of the yolk cells which causes the segmentation of the yolk (Figs. I and II). Adjacent yolk cells appear in some sections to be united by filaments, while the superficial yolk cells are, at times, connected with the blastoderm. Moreover the yolk cells are apparently connected with the amnion covering the embryo, consequently the entire egg may, perhaps, be regarded as a protoplasmic continuum. The embryo with the amnion in all probability originated as a thickening of the blastoderm, which, sinking into the yolk, formed the floor of a pit or invagination. The walls of this invagination then grew together and united above the floor. Consequently the embryo forming the floor of the invagination and the amnion forming the walls of the same were constricted off from the rest of the blastoderm and sinking deeper into the yolk came to lie near the centre of the egg. I have observed the stages of this process in Mantis, and in Thyridopteryx it is probably quite similar.

The embryo in the earliest stages examined was watch-glass shaped, with its convexity covered by the amnion. The latter consists of flattened branched cells with large nuclei. The embryo at this stage is a syncitium, thickly studded with nuclei, frequently in process of division. Later, a thickening extends along the major axis of the embryo on its concave side. At the same time a shallow groove is formed along the major axis on the convex side of the embryo (Fig. I). At this time the embryo has increased in length and become pear-shaped, the broad anterior end comprising the procephalic lobes. Metameric segmentation has commenced, successive somites being separated by incisions of the ectoderm. The mass of cells lying under the groove becomes separated by incisions from the outer layer. The process of separation is commencing in Fig. I. The mass of cells thus separated extends laterally on each side and ultimately forms a second layer lying beneath the outer ectoderm. The groove from the thickened floor, of which the inner layer is separated, may fairly be regarded as a blastopore, and has been described as such in the figures referred to. After the inner layer has been formed it separates into two bands. The point where the separation occurs is immediately beneath the blastopore. An ingrowth of cells then occurs at the blastopore and extends between the two bands of the inner layer. This ingrowth gives rise to the clear migratory cells, larger than the other cells of the embryo (Fig. II). At the same time the ectoderm lying near the lips of the blastopore thickens. It then separates into superficial and deeper portions. The latter gives rise to the ganglia of the nervous system (*n. s.*, Fig. II). The amnion then extends dorsally more rapidly than the body walls until the folds of the opposite sides unite (*I'*, Fig. II). By the union of the amniotic folds of opposite sides the embryo comes to lie free in a hollow sock of amnion. The dorsal wall of the embryo is formed by the union of the inner limbs of the amniotic folds. A portion of the inner germ layer then grows round and finally encloses the yolk taken into the body cavity by the union of the amniotic folds.

The cells of the inner layer which surround the yolk from the epithelium of the mid gut and consequently are to be regarded as endoderm cells. The large yolk cells apparently take no part in the formation of the latter. The fore and hind guts are formed as invaginations of the ectoderm before the formation of the mid gut. The latter arises from the last abdominal somite, the former, just behind the procephalic lobes. The tracheæ and limbs arise in the customary manner. That portion of the inner layer lining, the limbs, and body cavity is to be regarded as mesoderm. In late embryonic life most of the mesoderm appears to be converted into clear migratory cells. The nervous system arises as independent ganglia. The sub-œsophageal ganglion is formed by the union of the two maxillary with a portion of the mandibular ganglion. The last or tenth abdominal somite has a small ganglion.

Concerning the origin of the endoderm there has been considerable uncertainty. Balfour, speaking of the origin of the endoderm, says: "The origin of the hypoblast is still in dispute." Kowalevsky, as interpreted by Balfour, described the origin of the endoderm from the inner layer. Tichomeroff, from observations on silk worms, inclines to the same opinion. Dohrn, however, does not agree with Kowalevsky, while Balfour thinks that the endoderm may be formed from the central yolk cells. The numerous sections in my possession leave little doubt that the endoderm is formed from a portion of the inner layer which arises at the floor of the germinal groove or blastopore. The embryo of Thyridopteryx may then be fairly described as possessing a gastrula stage. Space does not permit references to literature.

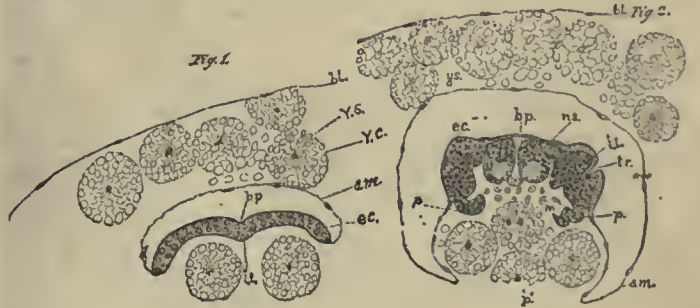


Fig. I.

am = Amnion.
bl. = Blastoderm.
bp = Blastopore.
ec = Ectoderm.
i. l. = Inner layer.
Y. s. = Yolk spherule.
Y. c. = Yolk cell.

Fig. II.

am. = Amnion.
bl. = Blastoderm.
bp. = Blastopore.
ec. = Ectoderm.
i. l. = Inner layer.
n. s. = Nerve system.
tr. = Tracheal invagination.
P. P. = Portion of inner layer which forms endoderm.
I' = Point where amniotic folds unite.

On the Artificial Propagation and Cultivation of Oysters in Floats. By W. K. Brooks.

Without expressing any opinion as to the value of the process of "*fattening*" oysters by placing them for a few days in cars floating in fresh water, I wish to point out that there is no similarity between this process and the process of propagation which is here described.

My attention was first called to the value of floating cars in oyster culture by Mr. William Armstrong, of Hampton, Virginia, who informed me, in 1884, that "*seed*" oysters, which he had placed in floating cars in the mouth of Hampton creek, grew more rapidly, and were of a better shape and more marketable than those which grew from seed planted on the bottom in the usual way.

One of the results of my study, in 1879, of the development of the oyster was the discovery that there is a period of several hours, immediately after the embryo acquires its locomotor cilia, when it swims at the surface, and this is the period when it is swept into contact with collectors. As soon as the shell appears the larva is dragged down by its weight, and either settles to the bottom and dies, or swims for a time near the bottom. The tendency to swim at the surface is an adaptation for securing wide distribution by means of the winds and currents which sweep the young oysters against solid bodies which may serve for attachment, and the greatest danger to which the oyster is exposed, at any part of its life, is that it may not, at the swimming stage, find a clean hard surface for attachment.

As it is microscopic and only about half as thick as a sheet of thin paper, it may be smothered by a deposit of sediment or mud so light as to be invisible, and most of the failures to get a good "set of spat" are due to the formation of a coat of sediment upon the collectors before the young oysters come into contact with them.

It occurred to me this summer that this danger could be entirely avoided by the use of floating collectors, for little sediment can fall on a body which is close to the surface of the water, and most of this will be swept away by currents, which will, at the same time, sweep the swimming embryos down into the collector, and thus insure an early, abundant and successful "set."

I accordingly constructed a floating car, made so as to permit the free circulation of the water. This was filled with clean oyster shells and moored in the channel in front of the laboratory at Beaufort, N. C., on July 4th. As all the oysters in the vicinity were in very shallow water they were nearly through spawning, and the conditions were therefore very unfavorable; but notwithstanding this, I immediately secured a good "set" and the young oysters grew with remarkable rapidity, on account of the abundant supply of food and fresh water which gained ready access to all of them, and the uniform temperature which was secured by the constant change of water.

This method of oyster culture may be applied in many ways; of which the most obvious is the production of seed oysters for planting.

The seed which is used for planting in Maryland and Virginia, as well as in Delaware and further north, is now procured from the natural beds of our waters, by tonging or dredging, and as the demand for oysters for this purpose is certainly one of the elements which have led to the depletion of our beds, there is a wide-spread feeling that the exportation of "seed" should be prohibited.

By a small investment of capital in floating collectors any one on tide-water could easily raise large quantities of much better, cleaner seed than that which is now procured from the natural beds, and if the laws permitted the sale and transportation of this seed without restriction at the season when the demand exists, it could be sold at a profit for less than the cost of tonging.

Northern planters could also raise seed for themselves by constructing floating collectors in the warm water of the sounds of Virginia and North Carolina, where the length of the summer would permit several collections to be made in one season. The oysters thus reared are large enough for planting in five or six weeks, and in the latitude of Beaufort there is an abundance of spat from the middle of April to the first of July, and it can be collected until September.

The method may also be used by planters for collecting their own seed, especially in regions remote from a natural supply. If there are no oysters near to furnish the eggs, a few spawning oysters may be placed among the shells in the collector, after the French method, to supply the "set."

It can also be used for the direct production of marketable oysters especially over muddy bottoms, and in regions where public sentiment does not permit any private ownership of the bottom.

As food for the oyster is most abundant at the mouths of muddy creeks where the bottom is too soft for oyster culture by planting or by shelling, this method will have especial advantage in such places, for there will be no danger of sanding or of smothering by mud at the surface, and there is no limit to the number of oysters which can thus be grown on a given area, for the free current of water will bring food to all of them.

The very rapid growth will more than compensate for the cost of the floats, and Mr. Armstrong's experiment shows that, in addition to all these advantages, the oysters are of a better shape, with better shells, and more marketable than those grown at the same place on the bottom.

Finally this method will do away with the necessity for a title to the bottom, and will thus enable a few enterprising men to set the example of oyster culture, and by the education of the community, to hasten the time when wiser laws will render our natural advantages available for the benefit of our people.

The most economical method of constructing floats must, of course, be determined by practical experiments, but a float constructed by connecting two old ship-masts together by string pieces, with a bottom of coarse galvanized iron netting, would have sufficient buoyancy and enough resistance to water to support a large quantity of submerged shells and oysters for two or more seasons, and a coating of copper paint each year would protect the timbers from worms.

The floats should be open at the ends to permit free circulation, and they should be moored in such a way as to swing with the current.

Engagement in business projects is no part of the office of a university, and I feel that the experiments of the past summer have brought the subject of oyster culture to a point where its further development should be left to the people who are most interested.

Notes on the Stomatopoda. By W. K. Brooks.

Two species of Stomatopoda are common at Beaufort; Squilla empusa, and a Lysiosquilla which, so far as I am aware, has never been described. The swimming larvae of both species are very abundant, but I have not succeeded in obtaining the eggs, nor was I able to keep the younger larvae alive in confinement, as they all died in moulting, although the older larvae moulted in aquaria. I was therefore compelled to rely upon general resemblances and measurements in my attempts to trace the metamorphosis, although the series were so complete that I believe my results are worthy of confidence.

The youngest Lysiosquilla larvae were in the same stage as Claus' larva. This stage is followed by an Erichthus stage, which persists for a number of moults, with little change except the increase in size and the gradual acquisition of the appendages.

I have witnessed the change from the last form of this series into the young Lysiosquilla, so it is now certain that the Erichthus type is the larva of this genus, although it is of course possible that other genera may pass through the same larval stages.

As secondary sexual characters are rare among the higher Crustacea, it is interesting to note that the female Lysiosquilla is much larger than the male, and of quite a different color. Fully grown males are from one and a half to two inches in length, while the females are from three to four inches long. The males are of a gray color and quite transparent, while the females are more opaque and of a dark olive green color, nearly black.

The habits of our two species are quite different. Lysiosquilla lives in pure sea sand on beaches which are directly exposed to the ocean swell, and it is very abundant on Bird Shoal and on the sea beach at Fort Macon. It lives in a deep cylindrical vertical burrow, which goes down for several feet, and it is almost impossible to procure the animals by digging. The males and females inhabit different burrows, and they lie in wait for prey at the top, which is arched over with sand, so that only the eyes of the animal are exposed. When suitable prey comes within reach they dart out so quickly that the eye can scarcely follow the motion, and seizing the prey in the large claws, they instantly retreat to the bottom of the burrow, where the food is stored away, and the animal returns to the mouth of the burrow to resume its watch. They seldom venture more than three or four inches from the

burrow, and I have obtained only one specimen which was captured in the water, although the trawl often brings up an abundant supply of the much larger Squilla empusa.

In constructing its burrow, Lysiosquilla brings up the sand from the bottom by armfuls, which are carried between the large claws to the mouth of the hole, to be deposited as far away as the animal can reach without leaving its burrow.

The burrows are so deep that digging for the animals is almost useless, and after many unsuccessful attempts to trap them, I found that it was easy to catch them by holding a piece of fish or crab near the mouth of the burrow as a bait, with one hand, while the other hand was held ready to cut off the retreat into the burrow, by the use of a tin trowel. Their movements are so very quick that many escaped entirely, while others were cut in two by the trowel, although many were captured alive.

Squilla empusa lives in hard muddy bottom, in or on the sides of channels where there is a rapid current, and it constructs a shallow U-shaped burrow, open at both ends. The burrow is excavated by the current of water produced by the abdominal appendages, and I have never seen them carrying sand out of the holes. They do not arch over the opening, and they are often found swimming at a distance of many feet from the hole, probably in pursuit of prey.

Squilla stridulates, by rubbing the serrated spine of the swimmeret across the serrated ridge on the ventral surface of the telson. The noise which is thus made under water can be clearly heard above the surface.

Note on the Fishes of Beaufort Harbor, N. C. By O. P. Jenkins.

In the Proceedings of the U. S. National Museum, 1878, is published a list of the fishes of Beaufort Harbor, N. C., by Profs. Jordan and Gilbert. This list includes both the fishes observed by Drs. Coues and Yarrow, and published by Dr. Yarrow in the Proceedings of the Philadelphia Academy of Natural Sciences for 1877, and those added by the work of Profs. Jordan and Gilbert. During the past summer while attending the session of the Marine Laboratory I made a collection of the fishes of the harbor.

Among the number obtained the following twenty species do not occur in either of the lists referred to. Several of the number are here for the first time recorded at a point on our coast so far north. The fishes of this collection have been placed in the Museum of the Indiana State University. Dr. Jordan has had the kindness to examine the collection, and has identified the species in this list.

1. Pristis pectinatus. Latham.
2. Gambusia patruelis. Baird and Girard.
3. Couger couger. Linnæus.
4. Tylosurus hians. Cuv. and Val.
5. Hippocampus punctulatus. Guichenot.
6. Querimana gyrans. Jordan and Gilbert.
7. Menidia menidia. Linnæus.
8. Elacate canada. Linnæus.
9. Chloroscombrus chrysurus. Linnæus.
10. Curaux latus. Agassiz.
11. Curaux bartholomaei. Cuv. and Val.
12. Nomeus gronovii. Gmelin.
13. Serranus subligarius. Cope.
14. Myeteroperca microlepis. Goode and Bean.
15. Gobius encaeomus. Jordan and Gilbert.
16. Gobiosoma bosci. Lacépède.
17. Paralichthys lethostigma. Jordan and Gilbert.
18. Etropus crossotus. Jordan and Gilbert.
19. Etropus microstomus. Gill.
20. Citharichthys macrops. Dresel.

A NOTE ON INHERITANCE.—Including a letter from Fritz Müller.

BY W. K. BROOKS.

In a recent article in the *Jenaische Zeitschrift für Naturwissenschaft.* (Bd. xviii, N. F. xi), Dr. Düsing briefly discusses my view of the nature of inheritance, as set forth in my book on "Heredity," and while he seems to be greatly disposed to accept my views on the whole, he points out certain difficulties which suggest themselves to him, and which seem to me to be the result of a failure to completely catch my meaning, but as other writers besides Dr. Düsing have called my attention to the same points, I am forced to believe that I have failed to express myself clearly.

Thus he says, p. 457: "Indessen scheint es mir, als ob Brooks in der Annahme, dass das Weibchen überhaupt gar nicht variire, zu weit gegangen wäre. Wenn es auch nicht unmöglich ist, so scheint es doch ausserordentlich unwahrscheinlich zu sein, dass die Geschlechtscharacter des Weibchens, z. B. die Milchdrüsen der Säugetiere, zuerst beim männlichen Geschlecht aufgetreten seien. Wenn die Weibchen gar nicht variirten, so hätte auch die weitere Ausbildung der Milchdrüsen zuerst bei den Männchen stattfinden müssen, bei denen sie später erst wieder reduciert worden wären. Weit einfacher ist es, bei der bisher allgemein gültigen Ansicht zu bleiben, dass das Weibchen ebenfalls variirt—allerdings in weit geringerem Masse, als das Männchen.

"Der beste Beweis für die Variabilität des weiblichen Geschlechtes zeigt sich bei der parthenogenetischen Fortpflanzung. Bei den Daphniden z. B. haben die parthenogenetischen Weibchen neue Eigenschaften erworben, welche sie von den Geschlechtsweibchen unterscheiden; sie sind z. B. nicht mehr befruchtungsfähig. Diese Eigenschaft können sie erst später erlangt haben, als sie bereits ungeschlechtlich producierte Jungfernweibchen waren, an einen männlichen Ursprung kann nicht gedacht werden. Es ist dies ein sicherer Beweis, dass auch die ungeschleehtlich producierten Weibchen variiren.

"Obgleich Brooks in seinem Werke auf die Möglichkeit eines männlichen Ursprunges der weiblichen Geschlechtscharactere hingewiesen hat, (Heredity, p. 240), so scheint er doch seine Meinung schon berichtigt zu haben, da er in dem oben stehenden Aufsatze (*Ueber ein neues Gesetz der Variation von W. K. Brooks, Jen. Zeit.*, xi. 452), unter 6 zugiebt, dass auch das Weibchen variiren kann, wenn auch seine Variation im allgemeinen nicht so stark ist, als die des Männchens."

If it were true that I have found it necessary to make such an essential change in my hypothesis less than two years after publication I should assuredly feel guilty of hasty publication of crude thoughts, but I think that a reference to the page of "Heredity" to which Dr. Düsing alludes will show that the statement in my own recent paper is not an amendment or a correction in any sense, and that the possibility of female variation is definitely set forth in the book on Heredity.

Page 240 opens with the following sentence: "We must recollect that our hypothesis does not demand that the power to transmit variations should be confined exclusively to males, *but simply that it should be more active in them than it is in the females*"; and on page 241: "The remarkable instinct which leads some species of cuckoos and crow-black birds to lay their eggs in the nests of other species must have originated in females, and a collection of all the cases which must be explained in the same way would make a formidable list; but the fact would still remain, that among animals with separate sexes such modifications are very much more frequent than female modifications, *and this is all that our theory requires.*"

These expressions seemed to me, when I wrote them, as they still seem to me, to recognize the possibility of female variation with as much definiteness as my statement on p. 435 of the Jenaische Zeitschrift, that "Eine Variation, welche zuerst in einem Männchen erscheint, hat viel mehr Wahrscheinlichkeit erblich zu werden als eine solche, welche zuerst in einem Weibchen erscheint."

The view which I have sought to express is that the functions of the two reproductive elements were originally alike, and that the ovum has gradually become specialized for transmitting the hereditary characteristics of the race, while the male element has gradually lost much of this power, and

has become specialized for the production of variations, while the ovum has gradually lost much of the power to excite variability. I do not assert, however, that this specialization is complete, and that the male cell has no power whatever to transmit hereditary characters, and the ovum no power to transmit variability, but simply that the two elements have become modified in their two divergent directions, and it seems to me that this fact will furnish a solution for another of Düsing's difficulties. On page 460 he says: "Die Eigenschaften, wodurch sich die Menschen von einander unterscheiden, sind Variationen oder Eigenschaften, die erst kurz vorher erworben wurden. Diese — es sind die, worauf man am meisten achtet — muss der Mann vererben, es muss also das Kind in seinen Eigenthümlichkeiten dem Vater gleichen — oder wenigstens durchschnittlich dem Vater mehr, als der Mutter. Im allgemeinen ist dies schwer zu untersuchen, aber es giebt doch Fälle, die uns Aufschluss geben können. Ein Christ mit hellen Haaren und blauen Augen ist mit einer Jüdin verheiratet; aber die zwei Kinder tragen jüdischen Typus. Wenn nun die Eigenschaften der Juden nicht zu den Grundcharacteren der Species gehören, so geht hieraus hervor, dass im Gegensatze zu der Theorie von Brooks auch neu erworbene Eigenthümlichkeiten von der Mutter vererbt werden können. Ist die Mutter Negerin, der Vater ein Weisser, so werden stets Mulatten erzeugt. Wenn also die Theorie von Brooks richtig ist, so müssen auch die Eigenschaften, welche den Neger vom Weissen, den Juden vom Christen unterscheiden, zu den seit sehr langer Zeit erworbenen Eigenschaften gerechnet, als Grundeigenschaften einer besonderen Rasse angesehen werden und daher von der Mutter vererbt werden können."

A third point which he brings forward involves the most interesting of all the phenomena of heredity; the latent transmission of characteristics, or polymorphic heredity. He says, page 459: "Wenn die Mutter nur die Charactere der Species vererbt, so müssten bei der parthenogenetischen Fortpflanzung immer nur dieselben Tiere wie die Mutter erzeugt werden. Dies aber ist nicht der Fall. Im Ueberfluss werden immer nur Jungfern-Weibchen geboren d. h. solche, welche ohne Männchen wieder Junge producieren. Sobald aber Mangel eintritt, hört diese starke Vermehrung auf, es werden nicht mehr Jungfernweibchen, sondern befruchtungsfähige Weibchen und Männchen geboren, die also nicht die Eigenschaften der Mutter besitzen. — Indessen könnte man doch darauf hinweisen, dass es sich hier nicht um eine Variation und auch nicht um das Auftreten von neu erworbenen Eigenschaften handelt, sondern dass auch die Eigenschaften dieser Geschlechtsgeneration zu den Grundcharacteren der Species gehören. Die Jungfernweibchen vererben nicht nur ihre eigenen Eigenschaften, sondern auch die Tendenz unter Umständen — nämlich im Falle eines Mangels — Tiere mit den Eigenschaften der Geschlechtsgeneration zu producieren."

In chapter V, of "Heredity" I have discussed this and similar cases at considerable length, and have tried to show that the explanation which Düsing suggests is the true one. On page 112 I say: "Certain embryo bees, when exposed to certain conditions, develop into sterile workers, but when exposed to another set of conditions they become fertile females. The differences between the workers and the queens are not confined to the reproductive organs, but extend to the shape and size of the body, the general organization, and to the instincts of the animals. These differences are not due to the direct action of the conditions to which the young are exposed, but are truly hereditary, as we see from the fact that the workers of different species are as distinct and as characteristic of their species as the males or the fertile females. . . .

"In the case of the polymorphic hydroids an egg-embryo may give rise by budding, to certain descendants with fully developed digestive organs, but with no organs of locomotion or reproductive organs, to other descendants with organs of locomotion, but without digestive organs or reproductive organs, and to still others with reproductive organs but with no organs of digestion or locomotion.

"All these forms are hereditary and are characteristic of the species, so there is no escape from the conclusion that they are all present in some form in the egg-embryo. . . .

"The hypothesis that the egg-embryo inherits and transmits to each of its descendants, those produced asexually as well as those produced sexually, all the characteristics of the species, and that it also inherits and transmits to each of them a tendency to suppress certain of these characteristics under certain conditions seems to furnish a simple and satisfactory explanation of all the facts. According to this view the feeding zooids of a polymorphic siphonophore are individuals which have inherited in full all the characteristics of the race, but which do not attain to perfect development in all respects. The swimming zooids are similar individuals, with other characteristics suppressed, and so on."

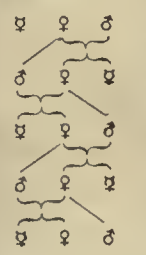
If this is the true view it is plain that the variation of zooids formed by budding, or that of animals which are borne parthenogenetically, does not differ essentially from that of animals born from sexual union, except that we must search for the origin of the tendency to vary in remote sexual ancestors, instead of in the parents.

The fact that polymorphic members of a community do inherit all the characteristics of the species, is shown, with remarkable clearness, in the following interesting letter which I received a few days ago from Fritz Müller:

Blumenau, Santa Catharina, Brazil, *July* 28, 1885.

Hochgeehrter Herr:

Bei dem Interesse, welches die Frage der Vererbung für Sie hat, darf ich mir wohl erlauben, Sie auf eine eigenthümliche Weise der Vererbung aufmerksam zu machen, die bei unseren Meliponen sich findet. Wie mir ein jüngerer Freund (M. Sagemehl in Amsterdam) schreibt, kann nach dem Baue des Kopfes und Thorax, auf den ja auch Packard besonderes Gewicht legt, kaum ein Zweifel sein, dass diese stachellosen Honigbienen (Melipona und Trigona) die nächsten Verwandten von Apis sind. Auch in ihrer Fortpflanzung stimmen sie insofern mit Apis überein, dass die fruchtbaren Weibchen (Königinnen) Kürzere, die Männchen (Drohnen) längere Zeit zu ihrer Entwicklung bedürfen, als die unfruchtbaren Weibchen (Arbeiter). Man darf also wohl annehmen, dass auch bei ihnen, wie bei Apis und anderen geselligen Hymenopteren die Weibchen (Königin und Arbeiter) aus befruchteten, die Männchen aus unbefruchteten Eiern sich entwickeln. Nun sind bei den vier hiesigen Melipona-arten, von denen ich alle drei Formen (♂, ♀ und ☿) kenne, die fruchtbaren Weibchen einander so ähnlich, dass die der drei grösseren Arten nur nach sorgfältigster Untersuchung, die der vierten, weit kleineren, auch fast nur durch ihre geringere Grösse zu unterscheiden sind. Die Männchen dagegen sind überaus verschieden sowohl von ihren eigenen Weibchen, als unter sich. Soweit hat der Fall nichts Ungewöhnliches, denn Ähnliches kommt ja auch bei vielen anderen Insecten vor. Aber,—und das ist das Merkwürdige,—die unfruchtbaren Weibchen oder Arbeiter gleichen nicht den fruchtbaren Weibchen, sondern den Männchen; sie sind diesen in Grösse, in Farbe, kurz in Allem so ähnlich, dass sie kaum durch die 12 gliedrigen (bei den ♂ 13 gliedrigen) Fühler, durch die ungespaltenen (bei den ♂ gespaltenen) Fussklauen und durch die Sammelkörbchen der Hinterschienen von ihnen sich unterschieden.—



Auch abgesehen von den Arbeitern, ist es bemerkenswerth dass unter den Kindern der Königin die ohne Zuthun eines Männchens erzeugten, vaterlosen Söhne nicht der Mutter, sondern dem Grossvater, dagegen die aus der Vereinigung mit einem Männchen hervorgegangenen fruchtbaren Töchter der Mutter gleichen.

Eine Beschreibung der vier Melipona-arten finden Sie in "Kosmos," Bd. III, 1878, pag. 228.

Vielleicht können Sie den Fall für Ihre Theorie der Vererbung verwerthen.

Mit hochtachungsvollem Grusse,

Ihr ergebener

Fritz Müller.

JOHNS HOPKINS

UNIVERSITY CIRCULARS

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CALENDAR, 1885–86.

1885, Thursday, October 1.	Academic Year Began.
" Thursday, December 24—Saturday, January 2.	Christmas Recess.
1886, Monday, February 22.	Commemoration Day.
" Friday, April 23—Monday, April 26.	Spring Recess.
" Tuesday, June 15.	Term of Instruction Closes.

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Opened for Instruction in 1876.

The Johns Hopkins University was founded by the munificence of a citizen of Baltimore, Johns Hopkins, who bequeathed the most of his large estate for the establishment of a University and a Hospital. It was intended that these institutions should coöperate in the promotion of medical education. The Hospital buildings are approaching completion.

The foundation of the University is a capital, in land and stocks, estimated in value at more than $3,000,000; the capital of the Hospital is not less in amount.

The University was incorporated under the laws of the State of Maryland, August 24, 1867. Power to confer degrees was granted by the Legislature in 1876.

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The Johns Hopkins University Circulars are published at convenient intervals during the academic year for the purpose of communicating intelligence to the various members of the University in respect to work which is here in progress, as well as for the purpose of promulgating official announcements from the governing and teaching bodies. During the current academic year, eight circulars will be issued in successive months, to be followed at the close of the year by an index.

Although these circulars are designed for the members of the University, they have frequently been called for by institutions and libraries at a distance, and also by individuals who are interested in the literary and scientific activity of this University. Subscriptions and exchanges are therefore received.

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The usage of giving personal notification has been discontinued, and those therefore who are interested in such announcements should hereafter consult the *Circulars*.

It will save much delay if applications for tickets and inquiries on these and other routine matters are addressed not to individuals but to the Johns Hopkins University, *by postal card*, and answers will be promptly returned by mail. Personal applications consume time needlessly.

☞ The lectures begin at 5 o'clock *punctually*. The doors of the hall are opened at fifteen minutes before 5, and the lectures do not exceed an hour in the delivery.

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The following publications are also issued by the University.

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The Annual Report presented by the President to the Board of Trustees reviewing the operations of the University during the past academic year.

The Annual Register giving the list of officers and students and stating the regulations of the University. Published at the close of the academic year.

The University Circulars, Annual Report, and Annual Register will be sent by mail for one dollar per annum.

Studies in Logic. By members of the Johns Hopkins University. C. S. Peirce, Editor. (Boston: Little, Brown & Co.) 1883. 123 pp., 12o. $2.

The Development and Propagation of the Oyster in Maryland. By W. K. Brooks. 1884. 193 pp., 4o. 13 plates and 3 maps. $5.

On the Mechanical Equivalent of Heat. By H. A. Rowland. 1880. 127 pp., 8o. $1.50.

New Testament Autographs. By J. Rendel Harris. 1882. 54 pp., 8o. 4 plates. 50 cents.

Sir William Thomson's Lectures on Molecular Dynamics. Delivered at the Johns Hopkins University in October, 1884. Reproduced from stenographic notes by the papyrograph plate process. 370 pp., 4o. $5.00.

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A. B., Johns Hopkins University, 1885. *Biology.*

WALTER B. CANFIELD. Baltimore. 43 *Cathedral St.*
A. B., Johns Hopkins University, 1884. *Chemistry and Mineralogy.*

HENRY CHANDLEE. Baltimore. 181 *Linden Av.*
M. D., University of Maryland, 1882, and Hahnemann Medical College, Philadelphia, 1883. *Biology.*

HENRY L. COAR. W. Springfield, Mass. 330 *N. Eutaw St.*
Cologne Gymnasium, 1884. *Geology.*

GEORGE P. COLER. Athens, O. 168 *N. Arlington Av.*
A. B., Ohio University, 1882. *History, etc.*

JOHN B. CRENSHAW. Ashland, Va. 241 *N. Eutaw St.*
A. M., Randolph Macon College, 1881. *Modern Languages.*

MELVIN E. CROWELL. Geneseo, N. Y. 255½ *W. Biddle St.*
A. B., University of Rochester, 1879. *Pedagogics, etc.*

JAMES CUMMINOS. Topsfield, Mass. 281 *Linden Av.*
A. B., University of Tennessee, 1880, and A. M., 1884. *English.*

DAVID T. DAY. Baltimore. 266 *N. Howard St.*
A. B., Johns Hopkins University, 1881, Fellow, 1882–84, and Ph. D., 1884. *Chemistry.*

CHARLES A. DOUBLEDAY. Montclair, N. J. 54 *McCulloh St.*
A. B., Amherst College, 1881. *Greek.*

CHARLES G. DUNLAP. Chillicothe, O. 266 *N. Howard St.*
A. B., Ohio Wesleyan University, 1883. *English.*

HENRY B. EDMISTON. Columbia, Tenn. 35 *McCulloh St.*
University of Virginia. *Romance Languages.*

GEORGE W. EDMOND. Portland, Me.
A. B., Johns Hopkins University, 1884. *Biology.*

EDWARD S. ELLIOTT. Savannah, Ga. 262 *W. Hoffman St.*
A. B. and A. M., University of the South, 1884. *Latin and Greek.*

HERBERT C. ELMER. Rushford, N. Y. 93 *W. Preston St.*
A. B., Cornell University, 1883. *Latin and Greek.*

JOHN A. FISHER. Baltimore. 85 *McCulloh St.*
Ph. B., Illinois Wesleyan University, 1880. *Philosophy and History.*

JOSEPH A. FONTAINE. Bué, France. 137 *N. Eutaw St.*
College of Sion, Nancy, France, 1879. *Romance Languages.*

ANDREW FOSSUM. Elon, Iowa. 180 *W. Biddle St.*
A. B., Norwegian Luther College, 1882. *Greek and History.*

OSCAR J. FROST. Argo, Colo. 202 *Druid Hill Av.*
B. M. E., University of Wisconsin, 1882, and M. E., 1885. *Chemistry.*

HENRY B. GARDNER. Providence, R. I. 49 *Cathedral St.*
A. B., Brown University, 1881. *History, etc.*

ROBERT W. GATEWOOD. Norfolk, Va. 58 *McCulloh St.*
U. S. Naval Academy, 1884. *Physics and Mathematics.*

JOHN GLENN, JR. Baltimore. 343 *N. Eutaw St.*
A. B., Johns Hopkins University, 1885.

GEORGE W. GOOCH. Henderson, N. C. 120 *N. Green St.*
A. B., Yadkin College, 1881. *Chemistry.*

MARK B. GRIER. Due West, S. C. 64 *McCulloh St.*
A. B., Erskine College, 1885. *Greek and Hebrew.*

MILTON HAIGHT. Pine Orchard, Ont. 52 *McCulloh St.*
A. B., University of Toronto, 1884. *Mathematics and Physics.*

GEORGE B. HALDEMAN. Cedarville, Ill. 16 *McCulloh St.*
A. B., Beloit College, 1883. *Biology.*

C. WILLARD HAYES. Hanover, O. 266 *N. Howard St.*
A. B., Oberlin College, 1883. *Chemistry.*

WILLIAM A. HEDRICK. Georgetown, D. C. 84 *Harlem Av.*
A. M., Columbian University, 1884. *Chemistry and Physics.*

JOHN C. HEMMETER. Baltimore. 204 *German St.*
M. D., University of Maryland, 1883. *Biology and Chemistry.*

GEORGE A. HENCH. Carlisle, Pa. 266 *N. Howard St.*
A. B., Lafayette College, 1885. *English.*

FRANCIS H. HERRICK. Tilton, N. H. 58 *McCulloh St.*
A. B., Dartmouth College, 1881. *Biology.*

HIRAM F. HIXSON. Ashland, Ohio. 130 *N. Eutaw St.*
Ph. B., Ashland College, 1881, and Ph. D., 1883. *Psychology.*

WILLIAM H. HOBBS. Auburn, Mass. 65 *McCulloh St.*
S. B., Worcester (Mass.) Free Institute, 1883. *Chemistry and Physics.*

WILLIAM P. HOLCOMB. Newtown, Pa. 122 *Cathedral St.*
L. B., Swarthmore College, 1878, and M. L., 1881. *History and Politics.*

JESSE H. HOLMES. Lincoln, Neb. 299 *N. Mount St.*
S. B., University of Nebraska, 1884. *Chemistry and Physics.*

JUNIUS M. HORNER. Oxford, N. C. 241 *N. Eutaw St.*
A. B., Johns Hopkins University, 1885. *Psychology.*

FRANK G. HUBBARD. Oswego, N. Y. 8 *McCulloh St.*
A. B., Williams College, 1880. *English.*

GEORGE B. HUSSEY. East Orange, N. J. 16 *McCulloh St.*
A. B., Columbia College, 1884. *Greek.*

JOSEPH L. JAYNE. Brandon, Miss. 58 *McCulloh St.*
U. S. Naval Academy, 1882. *Physics and Chemistry.*

OLIVER P. JENKINS. Terre Haute, Ind. *Beaufort, N. C.*
A. B., Moore's Hill College, 1869, and A. M., 1872. *Marine Laboratory.*

C. EDGEWORTH JONES. Augusta, Ga. 132 *W. Madison St.*
A. B., University of Georgia, 1885. *Latin, Greek, etc.*

JOSEPH H. KASTLE. Lexington, Ky. 330 *N. Eutaw St.*
S. B., Kentucky State College, 1884. *Chemistry.*

LOUIS KATZENSTEIN. Baltimore. 174 *Saratoga St.*
University of Berlin. *Teutonic Languages.*

P. OTIS KEILHOLTZ. Baltimore. 397 *Park Av.*
U. S. Naval Academy, 1884. *Physics.*

COURTNEY LANGDON. Bedford, Pa. 14 *North Av.*
Harvard College. *History (Sem.)*

MARION D. LEARNED. Dover, Del. 247 *Linden Av.*
A. B., Dickinson College, 1880, and A. M., 1883. *Modern Languages.*

ALVIN F. LINN. Springfield, O. 1 *McCulloh St.*
A. B., Wittenberg College (Ohio), 1884. *Chemistry.*

JAMES A. LOANE. Baltimore. 410 *N. Eden St.*
A. B., Johns Hopkins University, 1885.

HERBERT W. MAGOUN. Bath, Me. 327 *N. Eutaw St.*
A. B., Iowa College, 1879, and A. M., 1882. *Greek.*

JOHN M. MANSFIELD. Mt. Pleasant, Iowa. 345 *Penn. Av.*
A. B., Iowa Wesleyan University, 1864, and Ph. D., 1869. *Mathematics and Physics.*

JOHN E. MATZKE. Ridott, Ill. 134 *N. Eutaw St.*
A. B., Hope College, 1882. *Romance Languages.*

THOMAS MCCABE. New York City. 266 *N. Howard St.*
University of France; University of Rome. *Romance Languages.*

JAMES H. MCINTOSH. Newberry, S. C. 333 *N. Eutaw St.*
A. B., Newberry College, 1884. *Chemistry and Biology.*

FELIX T. MCWHIRTER. Greencastle, Ind. 330 *N. Eutaw St.*
A. B., East Tennessee Wesleyan University, 1873, and A. M., 1884; Ph. D., De Pauw University, 1885. *Chemistry and Physics.*

CASPAR O. MILLER. Baltimore. 210 *N. Howard St.*
M. D., University of Virginia, 1880; M. D., University of New York, 1881. *Biology.*

C. W. EMIL MILLER. Baltimore. 306 *S. Sharp St.*
A. B., Johns Hopkins University, 1882, and Fellow, 1883-85. *Greek.*

T. WESLEY MILLS. Montreal, Quebec. *Beaufort, N. C.*
A. B., University of Toronto, 1871, and A. M., 1872; M. D., McGill University, 1878, L. R., C. P. (Eng.); Lecturer on Physiology in McGill University, Montreal. *Marine Laboratory.*

WILLIAM M. MILROY. Northwood, O. 64 *McCulloh St.*
A. B., Geneva College, 1877; B. D., Yale College, 1882. *Latin and Greek.*

J. LEVERETT MOORE. Orange, N. J. 16 *McCulloh St.*
A. B., Princeton College, 1881, and A. M., 1884. *Latin.*

A. D. MORRELL. Chapel Hill, O. *Beaufort, N. C.*
Marine Laboratory.

PARK MORRILL. St. Johnsbury, Vt. 47 *Courtland St.*
A. B., Amherst College, 1881; U. S. Signal Service. *Physics.*

C. W. MOSSELL. Lockport, N. Y. 224 *Hanover St.*
A. B., Lincoln University, 1871; B. D., Boston University, 1874. *Shemitic Languages.*

AUGUSTUS T. MURRAY. New Bedford, Mass. 209 *N. Howard St.*
A. B., Haverford College, 1885. *Latin and Greek.*

HENRY F. NACHTRIEB. Minneapolis, Minn. *Beaufort, N. C.*
S. B., University of Minnesota, 1882; Professor of Zoology, University of Minnesota. *Marine Laboratory.*

JULIUS NELSON. Waupaca, Wis. 134 *N. Eutaw St.*
S. B., University of Wisconsin, 1881, and M. S., 1884. *Biology.*

JOHN C. C. NEWTON. Millersburg, Ky. 58 *N. Broadway.*
A. B., Kentucky Military Institute, 1874, and A. M., 1877. *History and Philosophy.*

GEORGE H. F. NUTTALL. San Francisco, Cal. *Baltimore and North Sts.*
M. D., University of California. *Biology.*

WILLIAM R. ORNDORFF. Baltimore. 382 *W. Lanvale St.*
A. B., Johns Hopkins University, 1884. *Chemistry and Mineralogy.*

INAZO OTA. Tokio, Japan. 4 *McCulloh St.*
S. B., Sapporo Agricultural College, 1881. *History and Politics.*

GEORGE T. W. PATRICK. Lyons, Iowa. 62 *Bolton St.*
A. B., State University of Iowa, 1878; B. D., Yale College, 1885. *Greek and Philosophy.*

JOSEPH E. PEIRSON. Pittsfield, Mass. 8 *McCulloh St.*
A. B., Williams College, 1883. *Greek and Latin.*

C. ALLEN PERKINS. Syracuse, N. Y. 173 *N. Calvert St.*
Romance Languages.

WILLIAM H. PERKINS, JR. Baltimore. 207 *Franklin St.*
A. B., Johns Hopkins University, 1884. *Political Economy.*

DAVID PHILIPSON. Baltimore. 205 *W. Lombard St.*
A. B., University of Cincinnati, 1883; Hebrew Union College (Cincinnati), 1883. *Shemitic Languages.*

CAMERON PIGGOT. Baltimore. 90 *N. Fulton St.*
M. D., University of Maryland, 1882. *Chemistry.*

S. Johnson Poe. Baltimore. 124 *St. Paul St.*
A. B., Princeton College, 1884. *History and Politics.*

Bolling A. Pope, Jr. New Orleans, La. 6 *McCulloh St.*
S. B., Tulane University, 1885. *Biology and Chemistry.*

Eldridge C. Price. Baltimore. 175 *Linden Av.*
M. D., University of Maryland, 1874, and Hahnemann Medical College, Philadelphia, 1874. *Biology.*

C. Byron Quincy. Salina, Kansas. 65 *McCulloh St.*
B. L., University of Wisconsin, 1883. *Psychology and Pedagogics.*

B. James Ramage. Newberry, S. C. (A)
A. B., Newberry College, 1880. *History.*

Franklin P. Ramsay. Troy, Ala. 215 *Druid Hill Av.*
A. B., Davidson College (N. C.), 1879, and A. M., 1885. *Shemitic Languages.*

Daniel R. Randall. Annapolis. 365 *N. Charles St.*
A. B., St. Johns College, 1883. *History and Politics.*

Wyatt W. Randall. Annapolis. 365 *N. Charles St.*
A. B., St. John's College, 1884. *Chemistry.*

James S. Reeve. Appleton, Wis. 105 *W. Lanvale St.*
A. B., Lawrence University, (Wis.) 1885. *Biology and Chemistry.*

Jacob M. Rich. New York City. *The Brexton.*
E. M., Columbia College, 1883, and C. E., 1884. *Physics and Chemistry.*

Benjamin T. Roberts, Jr. North Chili, N. Y. 255 *N. Carrollton Av.*
A. B., Johns Hopkins University, 1885. *Latin and Greek.*

Moses R. Ryttenberg. Baltimore. 72 *N. Front St.*
A. B., Johns Hopkins University, 1885. *History.*

Conway W. Sams. Baltimore. 619 *N. Gilmor St.*
LL. B., University of Maryland, 1884. *Political Economy.*

Edmund C. Sanford. Oakland, Cal. 8 *McCulloh St.*
A. B., University of California, 1883. *Psychology and Politics.*

Charles A. Schloegel. Baltimore. 169 *S. Bond St.*
Languages.

Henry S. Scribner. Plainfield, N. J. 80 *Bolton St.*
A. B., Princeton College, 1881. *Greek and Latin.*

Joseph S. Shefloe. Waukon, Iowa. 205 *W. Biddle St.*
A. B., Norwegian Luther College, 1885. *Latin and Greek.*

Moses Slaughter. Brooklyn, Ind. 352 *N. Eutaw St.*
A. B., Indiana Asbury University, 1883. *Latin and Greek.*

Robert N. Sloan. Baltimore. 43 *W. Eager St.*
A. B., Georgetown College, 1885. *English and Politics.*

A. Donaldson Smith. Philadelphia, Pa. 86 *W. Monument St.*
A. B., University of Pennsylvania, 1885, *Chemistry and Biology.*

Kirby W. Smith. Rutland, Vt. 123 *W. Madison St.*
A. B., University of Vermont, 1884. *Latin, etc.*

Albert H. Smyth. Philadelphia, Pa. 124 *W. Hoffman St.*
English.

Robert B. Steele. Lodi, Wis. 62 *Bolton St.*
A. B., University of Wisconsin, 1883. *Greek.*

Hugo Steiner. Baltimore. 23 *Hollins St.*
A. B., Johns Hopkins University, 1885. *History.*

Carlton B. Stetson. West Sumner, Me. 198 *Druid Hill Av.*
A. B., Colby University, 1881, and A. M., 1885. *Greek and Latin.*

James S. Trueman. St. John, N. B. 185 *Linden Av.*
A. B., Dalhousie College, 1882. *Greek and Latin.*

George M. Turner. Skaneateles, N. Y. 201 *N. Howard St.*
S. B., Amherst College, 1885. *Chemistry and Physics.*

Edward B. Van Vleck. Middletown, Conn. 201 *Park Av.*
A. B., Wesleyan University, 1884. *Mathematics and Physics.*

Samuel Wallis. New Orleans, La. 11 *Cathedral St.*
A. B., Georgetown College, (D. C.), 1884. *Chemistry.*

William F. Walz. Baltimore. 288 *E. Madison St.*
A. B., Johns Hopkins University, 1884. *Greek and Latin.*

Amos G. Warner. Roca, Neb. 299 *N. Mount St.*
B. L., University of Nebraska, 1885. *History and Politics.*

Henry H. Wiegand. Baltimore. 272 *Madison Av.*
A. B., Johns Hopkins University, 1885. *Physics.*

Arthur C. Wightman. Marion, S. C. 130 *N. Pine St.*
A. B., Wofford College, 1879. *Biology.*

John R. Wightman. Toronto, Ontario. 93 *Preston St.*
A. B., University of Toronto, 1871, and A. M., 1872. *Romance Languages.*

Lucius E. Williams. Macon, Ga. 330 *N. Eutaw St.*
A. B., Mercer University, 1885. *Chemistry and Physics.*

Henry V. Wilson. Baltimore. 314 *Linden Av.*
A. B., Johns Hopkins University, 1883. *Biology.*

John F. Woodhull. Chicopee, Mass. *Green and Saratoga Sts.*
A. B., Yale College, 1880. *Chemistry and Physics.*

(123)

Undergraduates.

Matriculates.

Joseph S. Ames. Faribault, Minn. 255 *N. Carrollton Av.*
Shattuck School. *Group II.*

Edward C. Applegarth. Baltimore. 632 *W. Fayette St.*
Baltimore City College. *Group III.*

H. Harold Ballard. Baltimore. 133 *Division St.*
Mr. G. G. Carey's School. *Group IV.*

Richard H. Bayard. Baltimore. 41 *Cathedral St.*
Mr. W. S. Marston's School. *Group VI.*

W. Lloyd Bevan. Baltimore. *Catonsville.*
Rev. W. Kirkus, Instructor. *Group I.*

J. William Black. Baltimore. 100 *W. Lanvale St.*
Baltimore City College. *Group VI.*

William Bromwell. Port Deposit. 73 *Charles St. Av.*
West Nottingham Academy. *Group IV.*

Hamilton M. Brown. Baltimore. 44 *North Av.*
Prof. C. Maupin, Instructor. *Group V.*

Arthur L. Browne. Baltimore. 2 *Huntingdon Av.*
Mr. W. S. Marston's School. *Group IV.*

Herbert M. Brune. Baltimore. 16 *North Av.*
St. Paul's School. *Group VI.*

Thomas H. Buckler. Baltimore. 135 *N. Charles St.*
Harvard College. *Group III.*

Charles E. Coates, Jr. Baltimore. 118 *Cathedral St.*
Westtown School (Pa.). *Group III.*

William R. Cole. Baltimore. 18 *Huntingdon Av.*
Mr. W. S. Marston's School. *Group I.*

Paul J. Dashiell. Port Republic. 266 *N. Howard St.*
St. John's College. *Group IV.*

William L. Devries. Baltimore. 72 *Cathedral St.*
Mr. H. W. Luckett, Instructor. *Group I.*

Alfred R. L. Dohme. Baltimore. 27 *Hollins St.*
Friends' High School, 1883. *Group IV.*

Albert A. Doub. Hagerstown. 372 *Lexington St.*
Washington County High School. *Group VI.*

George P. Dreyer. Baltimore. 168 *S. Broadway.*
Baltimore City College. *Group III.*

Edward Duffy, Jr. Baltimore. 430 *Park Av.*
Baltimore City College. *Group II.*

Edwin Eareckson, Jr. Baltimore. *High and Baltimore Sts.*
Mr. W. S. Marston's School. *Group II.*

William S. Eichelberger. Woodberry. 193 *Argyle Av.*
Baltimore City College, 1883. *Group II.*

Harry English. Washington, D. C. 84 *Harlem Av.*
Washington High School. *Group V.*

James C. Fifield. Kearney, Neb. 182 *N. Eutaw St.*
Phillips Academy (Andover). *Group VI.*

Abraham Flexner. Louisville, Ky. 23 *Hollins St.*
Louisville High School. *Group I.*

Julius Friedenwald. Baltimore. 88 *N. Eutaw St.*
Baltimore City College. *Group III.*

William E. Gates. Philadelphia, Pa. (A.)
Mr. George Easthuro, Instructor. *Group VII.*

Raleigh C. Gildersleeve. Baltimore. 253 *St. Paul St.*
Mr. W. S. Marston's School. *Group I.*

J. Elliott Gilpin. Baltimore. 162 *N. Howard St.*
Mr. G. G. Carey's School. *Group III.*

DOUGLAS H. GORDON. Baltimore. 27 *Franklin St.*
Mr. H. W. Luckett, Instructor. *Group VI.*

WILLIAM C. L. GORTON. Baltimore. 38 *S. Ann St.*
Baltimore City College. *Group II.*

JAY C. GUGGENHEIMER. Baltimore. 427 *Madison Av.*
Mr. W. S. Marston's School. *Group VI.*

J. EDWARD HARRY. Pylesville. 333 *N. Eutaw St.*
Maryland Normal School. *Group I.*

BENJAMIN H. HARTOGENSIS. Baltimore. 10 *Harrison St.*
Baltimore City College, 1883. *Group III.*

JAMES S. HODGES. Baltimore. 83 *Saratoga St.*
St. Paul's School, Concord, N. H. *Group I.*

OTTO HOFFMANN. New York City. 266 *N. Howard St.*
Dr. J. Sachs, Instructor. *Group I.*

THEODORE HOUGH. Baltimore. 181 *McCulloh St.*
Mr. W. S. Marston's School. *Group I.*

PERCY M. HUGHES. Washington, D. C. 65 *McCulloh St.*
Dickinson College. *Group I.*

WALTER JONES. Baltimore. 281 *Maryland Av.*
Baltimore City College. *Group II.*

WILLIAM A. JONES. Tuscaloosa, Ala. *The Albion.*
Mr. C. Maupin's School. *Group VI.*

ARTHUR L. LAMB. Baltimore. 187 *McCulloh St.*
Mr. E. M. Lamb's School. *Group III.*

ALLAN McLANE, JR. Baltimore. 37 *Cathedral St.*
Mr. H. W. Luckett, Instructor. *Group I.*

ROBERT M. McLANE, JR. Baltimore. 37 *Cathedral St.*
Mr. G. G. Carey's School. *Group I.*

JOHN H. T. McPHERSON. Baltimore. *The Albion.*
Baltimore City College. *Group V.*

COLYER MERIWETHER. Clark's Hill, S. C. 266 *N. Howard St.*
Vanderbilt University. *Group VI.*

W. HOWARD MILLER. Baltimore. 141 *E. Townsend St.*
Baltimore City College. *Group II.*

JOHN PLEASANTS. Baltimore. 66 *Mt. Vernon Pl.*
Mr. W. S. Marston's School. *Group VI.*

ROBERT W. ROGERS. Philadelphia. 263 *N. Howard St.*
University of Pennsylvania. *Group I.*

ARTHUR J. ROWLAND. Baltimore. 162 *N. Calhoun St.*
University of Pennsylvania. *Group I.*

CHARLES E. SIMON. Baltimore. 201 *Linden Av.*
Dr. E. Deichmann's School. *Group III.*

WILLIAM F. SMITH. Baltimore. 206 *Mosher St.*
Baltimore City College, 1883. *Group III.*

MICHAEL D. STEIN. Oakland, Cal. 115 *W. Lanvale St.*
University of California. *Group III.*

ROBERT M. TARLETON. Baltimore. 89 *W. Preston St.*
Mr. W. S. Marston's School. *Group VII.*

ROBERT T. TAYLOR. Baltimore. 225 *Maryland Av.*
Mr. W. S. Marston's School. *Group V.*

HENRY O. THOMPSON. Baltimore. 78 *W. Monument St.*
Mr. W. S. Marston's School. *Group I.*

BENJAMIN S. W. TUSKA. New York City. 40 *Laurens St.*
College of the City of New York. *Group VI.*

EDWARD L. WHITE. Baltimore. (A.)
Mr. W. S. Marston's School. *Group II.*

BERNARD WIESENFELD. Baltimore. 111 *E. Baltimore St.*
Harvard University. *Group VI.*

J. WHITRIDGE WILLIAMS. Baltimore. 201 *Madison Av.*
Baltimore City College. *Group III.*

LANGDON WILLIAMS. Boston, Mass. 77 *Cathedral St.*
Mr. W. S. Marston's School. *Group VI.*

WILLIAM K. WILLIAMS. Boston, Mass. 77 *Cathedral St.*
Mr. W. S. Marston's School. *Group VI.*

HENRY F. WINGERT. Hagerstown. 4 *McCulloh St.*
Washington County High School. *Group II.*

JOHN R. WINSLOW. Baltimore. 23 *McCulloh St.*
Friends' School, Providence, R. I. *Group III.*

ALLAN C. WOODS. Baltimore. 374 *Eutaw Pl.*
Mr. G. G. Carey's School. *Group VI.*

FREDERICK G. YOUNG. Beaver Dam, Wis. 87 *W. Preston St.*
Wisconsin Normal School. *Group VI.*

(Candidates for Matriculation.)

PAUL ALLEN. New York City. 209 *N. Howard St.*
Harvard College. *Group III.*

EDWARD A. BECHTEL. Colora. 73 *Charles St. Av.*
West Nottingham Academy. *Group I.*

WALTON BOLGIANO. Waverly. *Waverly.*
Dr. Deichmann's School. *Group III.*

JESSE C. BOYD. Baltimore. 103 *S. Broadway.*
Mr. W. S. Marston's School. *Group VI.*

CHARLES P. BRIGHAM. Baltimore. *McCulloh and Pressman Sts.*
Mr. W. S. Marston's School. *Group IV.*

CHARLES H. CAREY. Baltimore. 100 *Charles St. Av.*
Mr. G. G. Carey's School. *Group IV.*

FRANCIS M. CHISOLM. Baltimore. 55 *Franklin St.*
Mr. W. S. Marston's School. *Group III.*

JOHN B. DAISH. Washington, D. C. 266 *N. Howard St.*
Washington High School. *Group VI.*

RICHARD DORSEY. Baltimore. 205 *Franklin St.*
Baltimore City College. *Group VI.*

RANKIN DUVAL. Baltimore. 178 *Franklin St.*
Dr. Deichmann's School. *Group VI.*

CLARENCE H. FORREST. Annapolis. *Myrtle Av. and George St.*
St. John's College. *Group VI.*

HARRY W. HAHN. Chicago, Ill. 288 *W. Fayette St.*
Chicago High School. *Group VI.*

WILLIAM S. HILLES. Baltimore. 281 *N. Carrollton Av.*
Private Instruction. *Group VI.*

JOHN HENRY LAESSIG. Baltimore. 419 *W. Fayette St.*
Maryland College of Pharmacy. *Group IV.*

CHARLES D. LANIER. McDonogh. *McDonogh P. O.*
McDonogh School. *Group VI.*

ALBERT H. LOEB. Chicago, Ill. 291 *Lexington St.*
Chicago High School. *Group I.*

JOHN MACAULEY. Washington, D. C. 207 *W. Biddle St.*
Washington High School. *Group IV.*

GEORGE N. MOORE. Washington, D. C. *Washington, D. C.*
Washington High School. *Group III.*

OLIVER H. PALMER. Washington, D. C. 87 *W. Preston St.*
Haileybury College, England. *Group I.*

RICHARD H. PLEASANTS. Baltimore. 40 *Cathedral St.*
Mr. H. W. Luckett, Instructor. *Group VI.*

THOMAS N. POULLAIN. Baltimore. 410 *Eutaw Pl.*
Mr. W. S. Marston's School. *Group VII.*

FRANK E. READER. New Brighton, Pa. 213 *Mulberry St.*
Geneva College (Pa.). *Group VI.*

DAVID E. ROBERTS. Baltimore. 7 *Tome St.*
Pennsylvania State College. *Group IV.*

LESSING ROSENTHAL. Chicago, Ill. 291 *Lexington St.*
Chicago High School. *Group I.*

FRANK W. TAYLOR. McDonogh. 268 *Mosher St.*
McDonogh School. *Group II.*

HORATIO A. WARREN. Collinsville, Conn. 49 *E. Chase St.*
Collinsville High School.

ROBERT W. H. WEECH. Baltimore. 398 *Madison Av.*
Baltimore City College. *Group II.*

JOHN WHITE, JR. Poolesville. 258 *Linden Av.*
Charlestown (W. Va.) Academy. *Group IV.*

WILLIAM F. WILLOUGHBY. Alexandria, Va. 266 *N. Howard St.*
Washington High School. *Group VI.*

WESTEL W. WILLOUGHBY. Alexandria, Va. 266 *N. Howard St.*
Washington High School. *Group VI.*
(94)

Preliminary Medical.

L. BRADLEY DORR. Buffalo, N. Y. 241 *N. Eutaw St.*
Buffalo (N.Y.) High School.

THOMAS S. FEARN. Summit, N. J. 132 *W. Madison St.*
Dr. J. Sachs, New York, Instructor.

ALFRED MANN. Milwaukee, Wis. 52 *McCulloh St.*
Milwaukee High School.

HARRY O'DONOVAN. Baltimore. 115 *W. Monument St.*
Mr. W. S. Marston's School.

JOSEPH F. SHEMWELL. Prince Frederick. 52 *Conway St.*
Charlotte Hall School.

AUDLEY H. STOW. Baltimore. 435 *N. Mount St.*
Baltimore City College.

EDWARD W. WILLIS. Baltimore. 380 *E. Baltimore St.*
Baltimore City College.
(7)

Special Students.

CHARLES A. BOSTON. Baltimore. 79 *St. Paul St. Ex.*
Law Department, University of Maryland. *History and Politics.*

CORNELIUS BRUYN. Kingston, N. Y. 333 *N. Eutaw St.*
Rutgers College. *Languages.*

CHARLES T. CHILD. Richmond, Va. 8 *McCulloh St.*
Richmond College. *Physics.*

THOMAS CRADOCK. Pikesville. *Pikesville.*
Dr. Deichmann's School. *Physics, etc.*

RICHARD H. DAVIS. Philadelphia, Pa. 187 *Madison Av.*
Lehigh University. *History and Politics.*

HORACE M. ENGLE. Marietta, Pa. 35 *McCulloh St.*
Lehigh University. *Chemistry, etc.*

RICHARD F. ENSEY, JR. St. Denis. 106 *W. Biddle St.*
Baltimore City College. *Mathematics and Physics.*

WILLIAM C. FERGUSON. Richmond, Ind. 86 *W. Monument St.*
Richmond High School. *History and Politics.*

CORNELIUS FERRIS, JR. Denver, Colo. 86 *W. Monument St.*
Denver High School. *History, etc.*

JOHN L. HALL. Richmond, Va. 83 *Green St.*
Randolph Macon College. *Teutonic Languages.*

WILLIAM E. HAMILTON, JR. Shreveport, La. 330 *N. Eutaw St.*
Washington and Lee University. *Chemistry.*

EDWARD T. HELFENSTEIN. Frederick. 382 *Druid Hill Av.*
Episcopal High School (Va.). *Latin and Greek.*

RAYMOND L. HENDERSON. Hancock. 611 *N. Gilmor St.*
Columbian University. *Chemistry.*

ALBERT B. HOEN, Waverly. *Waverly.*
Loyola College. *Chemistry.*

HARRY C. JONES. New London. 266 *N. Howard St.*
Western Maryland College. *Chemistry and Physics.*

JOHN C. MASON. Baltimore. 169 *St. Paul St.*
St. Paul's School. *Chemistry and Biology.*

WILLIAM R. MOLINARD. Baltimore. 236 *Linden Av.*
Dr. Deichmann's School. *Mathematics and Physics.*

C. KEENER MOUNT. Baltimore. 169 *Linden Av.*
Mr. W. S. Marston's School. *Chemistry.*

JAMES M. PATTERSON. Denver, Colo. 66 *N. Paca St.*
Arnstadt (Germany) Gymnasium. *History, etc.*

WILLIAM B. D. PENNIMAN. Howard Co. *St. Denis P. O.*
Baltimore City College. *Chemistry.*

ALEXANDER PRESTON. Baltimore. 466 *Eutaw Place.*
Mr. G. G. Carey's School. *Latin, etc.*

D. MEREDITH REESE. Baltimore. 427 *Linden Av.*
Baltimore City College. *History and Languages.*

WILLIAM P. REEVES. Richmond, Ind. 86 *W. Monument St.*
Earlham College. *English and German.*

WILLIARD G. ROUSE. Belair. 243 *N. Carrollton Av.*
Belair Academy. *History and Politics.*

MORRIS P. STEVENS. Baltimore. 254 *Linden Av.*
Baltimore City College. *Mathematics and Physics.*

IRVIN J. STRAUS. Baltimore. 136 *N. Calhoun St.*
Mr. W. S. Marston's School.

CHARLES K. SWARTZ. Gettysburg, Pa. 73 *Edmondson Av.*
Pennsylvania College. *Biology and Chemistry.*

A—Absent.
(27)

HONORS.

Scholars on the Foundation.

UNIVERSITY SCHOLARS.

(*Appointed* 1885).

J. P. Campbell,	Va.	J. A. Loane,	Md.
J. M. Horner,	N. C.	W. R. Orndorff,	Md.
C. H. Howard,*	Md.	H. V. Wilson,	Md.

*Resigned, October, 1885.

HONORARY HOPKINS SCHOLARS.

(*Appointed* 1883.)

W. C. L. Gorton,	Md.	J. H. T. McPherson,	Md.
W. F. Smith,	Md.	E. L. White,	Md.
A. C. Woods,	Md.	(*Appointed* 1885.)	
(*Appointed* 1884.)		G. P. Dreyer,	Md.
E. C. Applegarth,	Md.	W. H. Miller,	Md.
T. Hough,	Va.	R. C. Gildersleeve,	Md.

HOPKINS SCHOLARS.

(*Appointed* 1885).

		A. L. Browne,	Md.
H. H. Ballard,	Md.	W. L. Devries,	Md.
H. M. Brown,	Md.	C. E. Simon,	Md.

TABULAR STATEMENTS.

I. ACADEMIC STAFF, 1885–86.

President and Professors,	11
Lecturers,	2
Associate Professors,	10
Associates,	10
Instructors and Assistants,	10
	43

II. ENROLLED STUDENTS, 1885–86.

Graduate (including Fellows),	161
Matriculate,	94
Special,	34
	289

III. SUMMARY, 1876–85.

Years.	Teachers.	Total Enrolled Students.	Graduate Students, including Fellows.	Matriculates, including Candidates.	Special, including Prel. Med.	Degrees Conferred. A. B.	Degrees Conferred. Ph. D.
1876–77.....	29[a]	89	54	12	23	—	—
1877–78.....	34	104	58	24	22	—	4
1878–79.....	25	123	63	25	35	3	6
1879–80.....	33	159	79	32	48	16	5
1880–81.....	39	176	102	37	37	12	9
1881–82.....	43	175	99	45	31	15	9
1882–83.....	41	204	125	49	30	10	6
1883–84.....	49	249	159	53	37	23	15
1884–85.....	52	290	174	69	47	9	13
1885–86[b]...	43	289	161	94	34	—	—

[a] In the first two years the number of non-resident lecturers was much larger than it has been since.
[b] In 1885–86, the numbers are given for October, 1885, at the opening of the academic year.

IV. CLASSIFICATION BY RESIDENCES OF STUDENTS, 1885–86.

Maryland (Baltimore, 102)	124	Connecticut,	3
New York,	20	Kentucky,	3
Massachusetts,	14	Louisiana,	3
Pennsylvania,	13	Maine,	3
Ohio,	8	Minnesota,	2
District of Columbia,	8	New Hampshire,	2
Illinois,	6	Rhode Island,	1
New Jersey,	6	Delaware,	1
South Carolina,	6	Michigan,	1
Virginia,	6	Mississippi,	1
Georgia,	5	Tennessee,	1
Indiana,	5	West Virginia,	1
Iowa,	5	Kansas,	1
Wisconsin,	5		
California,	4	Canada,	7
Colorado,	4	Japan,	2
Nebraska,	4	China,	1
North Carolina,	4	France,	1
Vermont,	4	Germany,	1
Alabama,	3		

V. ATTENDANCE UPON THE VARIOUS COURSES OF INSTRUCTION, 1885–86.

Mathematics,	47	German,	111
Physics,	51	Romance Languages,	61
Chemistry,	89	English and Anglo-Saxon,	54
Mineralogy,	47	History and Political Science,	97
Biology,	48	Psychology and Pedagogics,	49
Greek,	40	Logic,	28
Latin,	71	Elocution,	52
Shemitic Languages,	14	Drawing,	64
Sanskrit, etc.,	31		

VI. LIST OF INSTITUTIONS IN WHICH THE STUDENTS ENROLLED (1885–86) WERE GRADUATED.

Johns Hopkins University,	23	University of Göttingen,	1
Harvard University,	6	University of Georgia,	1
University of Maryland,	6	Hamilton College,	1
Amherst College,	5	Haverford College,	1
Princeton College,	5	Illinois Wesleyan University,	1
University of Toronto,	5	Iowa College,	1
U. S. Naval Academy,	4	Iowa Wesleyan University,	1
University of Wisconsin,	4	Iowa State University,	1
Yale College,	4	Jefferson Medical College,	1
University of California,	3	Kentucky State College,	1
University of Nebraska,	3	Kentucky Military Institute,	1
Norwegian Luther College,	3	Lafayette College,	1
University of Pennsylvania,	3	Lawrence University,	1
Columbia College,	2	University of Leipsic,	1
Cornell University,	2	McGill University,	1
Dalhousie University (Nova Scotia),	2	Lincoln University,	1
Dartmouth College,	2	University of Michigan,	1
Davidson College,	2	University of Minnesota,	1
De Pauw University,	2	Moore's Hill College (Ind.),	1
Georgetown College (D. C.)	2	University of North Carolina,	1
Hope College,	2	University of N. Y.,	1
Mercer University,	2	New Brunswick Theological Seminary,	1
University of Munich,	2	Oberlin College,	1
Newberry College,	2	Ohio University,	1
University of Rochester,	2	Ohio Wesleyan University,	1
Sapporo Agric. College (Japan),	2	College of Nancy (France),	1
St. John's College (Md.),	2	Randolph Macon College,	1
University of Virginia,	2	University of the South,	1
University of Vermont,	2	Stuttgart Gymnasium,	1
Williams College,	2	Swarthmore College,	1
Ashland College (Ohio),	1	Syracuse University,	1
Beloit College,	1	University of Tennessee,	1
University of Berlin,	1	East Tennessee Wesleyan University,	1
Boston University,	1	Trinity College (Conn.),	1
Brown University,	1	University of Tübingen,	1
University of Cincinnati,	1	Tulane University,	1
Colby University,	1	Victoria University (Canada),	1
Columbian University (D. C.),	1	Washington and Lee University,	1
University of Colorado,	1	Wesleyan University (Conn.),	1
Cologne Gymnasium,	1	Wittenberg College (Ohio),	1
Dickinson College,	1	Wofford College (S. C.),	1
Emory College (Ga.),	1	Worcester (Mass.) Free Institute,	1
Erskine College (S. C.),	1	Yadkin College (N. C.),	1
Geneva College,	1		

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CONSULTATION HOURS.

Students are requested to call at the hours named, unless there are exceptional reasons for coming at some other time. The person named will usually be accessible for some minutes after the appointed hour. The appointments do not include Saturday.

GILMAN, D. C.	*President's Office.*	12-1 p. m.
ADAMS, H. B.	*Bluntschli Library,*	9 a. m.
BLOOMFIELD, M.	111 *W. Monument St.*	Mon. Tues. Frid., 1 p. m.
BRIGHT, J. W.	117 *W. Monument St.*	except Monday., 4 p. m.
BROOKS, W. K.	*Biological Laboratory.*	10 a. m.
BROWNE, W. H.	*Library.*	9 a. m. to 5 p. m.
CRAIG, T.	*Room* 17.	9 a. m.
ELY, R. T.	*Bluntschli Library.*	11 a. m.
ELLIOTT, A. M.	111 *W. Monument St.*	12 m.
FRANKLIN, F.	*Room* 13.	12 m.
GILDERSLEEVE, B. L.	181 *Howard St.*	11 a. m.
GOEBEL, J.	209 *N. Howard St.*	12 m.
HALL, G. S.	113 *W. Monument St.*	10 a. m.
HARTWELL, E. M.	*Gymnasium.*	12 m.
HAUPT, P.	113 *W. Monument St.*	Tues. W. Th., 5 p. m.
HEMPL, G.	111 *W. Monument St.*	4 p. m.
HOWELL, W. H.	*Biological Laboratory.*	2 p. m.
JAMESON, J. F.	*Bluntschli Library.*	12 m.
KIMBALL, A. L.	*Room* 5.	11 a. m.
MARTIN, H. N.	*Biological Laboratory.*	2.30 p. m.
MCMURRICH, J. P.	*Biological Laboratory.*	12 m.
MORRIS, C. D.	181 *Howard St.*	11 a. m.
MORSE, H. N.	*Chemical Laboratory.*	11 a. m.
NEWCOMB, S.	*Room* 14.	Tues. and Thurs., 10 a. m.
NEWELL, H.	*Room* 19.	(except Wed.) 1 p. m. to 5 p. m.
PERKINS, C. A.	*Physical Laboratory.*	9 a. m.
REMSEN, I.	*Chemical Laboratory.*	11 a. m.
RENOUF, E.	*Chemical Laboratory.*	10 a. m.
ROWLAND, H. A.	*Physical Laboratory.*	9 a. m.
SPIEKER, E. H.	181 *Howard St.*	10 a. m.
STORY, W. E.	*Room* 15.	M. W. Fri., 12 m.; Tu., Th., 10.30 a. m.
TODD, H. A.	117 *W. Monument St.*	12 m.
WARREN, M.	181 *Howard St.*	12 m.
WELCH, W. H.	*Biological Laboratory.*	3 p. m.
WILLIAMS, G. H.	*Chemical Laboratory.*	9 a. m.
WOOD, H.	187 *Howard St.*	(exc. Wed.) 12 m.; Wed., 1 p. m.
WOODWORTH, C. L.	*Hopkins Hall.*	9 a. m. to 12 m.

ENUMERATION OF CLASSES, FIRST HALF-YEAR, 1885-86.

Mathematics. (47 Students).

Classes meet in Rooms 8, 14, and 16.

Practical and Theoretical Astronomy: PROFESSOR NEWCOMB. Twice weekly, Tuesday and Thursday, 9 a. m. (9).

Barcroft.	Campbell, G. M.	Haight.	Nixon.
Bell, L.	Fields.	Hixson.	Van Vleck.
Blandin.			

Mathematical Seminary: PROFESSOR NEWCOMB. Weekly, Wednesday. (Not yet organized).

Mathematical Seminary: DR. STORY. Weekly, Tuesday, 8 p. m. (4).

Barcroft.	Fields.	Haight.	Nixon.

Introductory Course for Graduates: DR. STORY. Daily, 11 a. m. (7).

Ames.	Eichelberger.	Rich.	Wicgand.
Campbell, G. M.	Gorton.	Van Vleck.	

Finite Differences and Interpolation: DR. STORY. Twice weekly, Tuesday and Thursday, 12 m. (5).

Ames.	Campbell, G. M.	Fields.	Haight.
Barcroft.			

Advanced Analytic Geometry: (*Higher Plane Curves*): DR. STORY. Three times weekly, Monday, Wednesday, and Friday, 1 p. m. (4).

Barcroft.	Fields.	Haight.	Nixon.

Conic Sections: (*Minor Course*): DR. STORY. Twice weekly, Tuesday and Thursday, 1 p. m. (15).

Ballard.	Dashiell.	Miller, W. H.	White.
Brigham.	Eareckson.	Molinard.	Wiegand.
Browne, A. L.	Ensey.	Roberts, D. E.	Wingert.
Coar.	Jones, W.	Taylor, F. W.	

Hydrodynamics: (*Lamb*): DR. CRAIG. Three times weekly, Monday, Wednesday, and Friday, 1 p. m. (4).

Blandin.	Crew.	Gatewood.	Keilholtz.

Theory of Functions: (*Hermite, Briot et Bouquet, Fuchs, Tannery, etc.*): DR. CRAIG. Three times weekly, Monday, Wednesday, and Friday, 10 a. m. (4).

Barcroft.	Fields.	Haight.	Nixon.

Differential Equations: (*Forsyth*): *Major Course:* DR. CRAIG. Twice weekly, Tuesday and Thursday, 11 a. m. (8).

Child.	Duffy.	Jayne.	Weech.
Crew.	English.	McPherson.	Wingert.

Linear Differential Equations: (*Fuchs*): DR. CRAIG. Twice weekly, Tuesday and Thursday, 10 a. m. (4).

Barcroft.	Fields.	Haight.	Nixon.

Mathematical Seminary: DR. CRAIG. Weekly. (Not yet organized).

Problems in Mechanics: DR. FRANKLIN. Twice weekly, Monday and Friday, 5 p. m. (6).

Ames.	Campbell, G. M.	Gatewood.	Jayne.
Barcroft.	Child.		

Theory of Equations: (*Todhunter*): DR. FRANKLIN. Three times weekly, Monday, Wednesday, and Friday, 11 a. m. (6).

Duffy.	Laessig.	Weech.	Wingert.
English.	McPherson.		

Differential and Integral Calculus: DR. FRANKLIN. Three times weekly, Monday, Wednesday, and Friday, 1 p. m. (13).

Ballard.	Eareckson.	Jones, W.	Stevens.
Brigham.	Ensey.	Miller, W. H.	Taylor, F. W.
Browne, A. L.	Hoffmann.	Roberts, D. E.	White.
Dashiell.			

Trigonometry: DR. FRANKLIN. Three times weekly, Monday, Wednesday, and Friday, 4 p. m. (7).

Carey.	Loeb.	Moore, G. N.	Rosenthal.
Hilles.	Macauley.	Reader.	

Physics. (51 Students).

Classes meet in Rooms 3, 4, 7, and 8.

Thermodynamics: PROFESSOR ROWLAND. Daily, 10 a. m. (11).

Bell, L.	Crew.	Gorton.	Mansfield.
Blandin.	Eichelberger.	Jayne.	Merrill.
Child.	Gatewood.	Keilheltz.	

Major Course: DR. KIMBALL. Daily, 12 m. (15).

Child.	Hedrick.	Nixon.	Turner.
Dohme.	Holmes.	Randall, W. W.	Wiegand.
Emersen, W. H.	Jayne.	Rich.	Wingert.
Enacy.	Laessig.	Stevens.	

General Physics: DR. KIMBALL. Daily, 10 a. m. (23).

Bevan.	Fearn.	Hughes.	Meriwether.
Belgiane.	Gilpin.	Jones, H. C.	Molinard.
Cradeck.	Guggenheimer.	Lanier.	Moore, G. N.
Dorr.	Harry.	Macauley.	Simon.
Duffy.	Hodges.	Mann.	Weech.
Eareckson.	Hough.	McWhirter.	

Laboratory Work:

Advanced Students: PROFESSOR ROWLAND. (9).

Ames.	Child.	Gatewood.	Keilholtz.
Bell, L.	Crew.	Jayne.	Merrill.
Blandin.			

Class in General Physics: DR. KIMBALL and DR. PERKINS. (27).

Allen, P.	Fearn.	Hughes.	Molinard.
Bevan.	Flexner.	Jones, H. C.	Moore, G. N.
Belgiaee.	Gilpin.	Lanier.	Randall, W. W.
Cradeck.	Guggenheimer.	Macauley.	Simon.
Dorr.	Harry.	Mann.	Turner.
Duffy.	Hodges.	McWhirter.	Weech.
Eareckson.	Hough.	Meriwether.	

Chemistry. (89 Students).

Classes meet in the Chemical Laboratory.

Chemistry of the Carbon Compounds: PROFESSOR REMSEN. Twice weekly, Monday and Tuesday, 9 a. m. (37).

Applegarth, E. C.	Hartegensia.	McIntesh.	Roberts, D. E.
Brackett, R. N.	Hayes.	McWhirter.	Smith, W. F.
Buckler.	Hedrick.	Meunt.	Stein.
Canfield.	Hemmeter.	Palmer, C. S.	Swartz.
Coar.	Hobbs.	Penniman.	Turner.
Dohme.	Holmes.	Piggot.	Wallis.
Friedenwald.	Kemp.	Pope.	Williams, J. W.
Frost.	Laessig.	Randall, W. W.	Winslow.
Gooch.	Linn.	Rich.	Woodhull.
Hamilton.			

General Chemistry: PROFESSOR REMSEN. Lectures three times weekly, Wednesday, Thursday, and Friday, 9 a. m. (48).

Allen, P.	Duvall.	Hartegensis.	Palmer, C. S.
Ames.	Eareckson.	Henderson.	Pope.
Boyd.	Eichelberger.	Jayne.	Reese.
Brill.	Engle.	Jones, H. C.	Reeve.
Bremwell.	English.	Keilholtz.	Shemwell.
Chilsolm.	Fearn.	Lamb.	Simon.
Coates.	Fifield.	Mann.	Smith, A. D.
Crew.	Forrest.	Mason.	Stevens.
Dashiell.	Gilpin.	McWhirter.	Stow
Dorr.	Gooch.	Molinard.	Strauss.
Deub.	Gorten.	Moore, G. N.	Williams, L. E.
Dreyer.	Hamilten.	O'Donevan.	Willis.

Laboratory Methods and Theoretical Chemistry: DR. MORSE. Twice weekly, Thursday and Friday, 9 a. m. (25).

Applegarth, E. C.	Hedrick.	Meunt.	Swartz.
Buckler.	Hemmeter.	Penniman.	Turner.
Coar.	Hobbs.	Randall, W. W.	Wallis.
Dohme.	Holmes.	Rich.	Williams, J. W.
Friedenwald.	Linn.	Smith, W. F.	Winslow.
Frost.	McIntosh.	Stein.	Woodhull.
Hayes.			

Laboratory Work: PROFESSOR REMSEN, DR. MORSE, and DR. RENOUF. (82).

Allen, P.	Duggan.	Hobbs.	Pleasants, J.
Ames.	Duvall.	Hoen.	Pope.
Applegarth, E. C.	Eareckson.	Holmes.	Randall, W. W.
Bayley.	Eichelberger.	Jones, H. C.	Reese.
Bell, C. J.	Emersen, W. H.	Kastle.	Reeve.
Bell, L.	Engle.	Keilholtz.	Shemwell.
Boyd.	English.	Kemp.	Simon.
Brackett, R. N.	Fearn.	Lamb.	Smith, A. D.
Brill.	Fifield.	Liebig.	Smith, W. F.
Bromwell.	Forrest.	Linn.	Stein.
Buckler.	Friedenwald.	Mann.	Stevens.
Canfield.	Frost.	Mason.	Stew.
Chisolm.	Gilpin.	McIntesh.	Strauss.
Cear.	Gooch.	Molinard.	Turner.
Coates.	Gorton.	Moore, G. N.	Wallis.
Crew.	Hamilten.	O'Donevan.	Williams, J. W.
Dashiell.	Hartogensis.	Ornderff.	Williams, L. E.
Dohme.	Hayes.	Palmer, C. S.	Willis.
Derr.	Hedrick.	Penniman.	Winslow.
Deub.	Hemmeter.	Pigget.	Woodhull.
Dreyer.	Henderson.		

Mineralogy, Etc. DR. WILLIAMS. (47 Students).

Mineralogy and Petrography: (*Advanced*). Lectures three times weekly, Wednesday, Thursday, and Friday, 11 a. m. Saturday, 9 a. m.–12 m., Quiz and Practicum. (10).

Bayley.	Coar.	Hedrick.	Orndorff.
Brackett, R. N.	Emerson, W. H.	Hobbs.	Palmer, C. S.
Canfield.	Hayes.		

Mineralogy: (*Elementary*). DR. WILLIAMS. Weekly, Monday, 9 a. m. (37).

Allen, P.	Dorr.	Gerton.	Reeves.
Ames.	Earecksen.	Henderson.	Reese.
Boyd.	Eichelberger.	Jones, H. C.	Shemwell.
Bromwell.	Engle.	Keilholtz.	Simon.
Chisolm.	English.	Lamb.	Stevens.
Coates.	Fearn.	Mann.	Stew.
Dashiell.	Fifield.	Mason.	Strauss.
Doub.	Forrest.	Moore, G. N.	Willis.
Dreyer.	Gilpin.	O'Donovan.	Woods.
Duvall.			

Laboratory Work: DR. WILLIAMS. (4.)

Bayley.	Coar.	Hayes.	Palmer, C. S.

Biology. (48 Students).

Classes meet in the Biological Laboratory.

General Biology: PROFESSOR MARTIN. Three times weekly, Monday, Wednesday, and Friday, 10 a. m. (22).

Allen, P.	Gooch.	Reese.	Stow.
Applegarth, E. C.	Hemmeter.	Reeve.	Straus.
Coates.	Lamb.	Rich.	Swartz.
Donaldson.	Nuttall.	Shemwell.	Williams, L. E.
Dreyer.	O'Donovan.	Smith, A. D.	Willis.
Friedenwald.	Pope.		

Animal Physiology and Histology: PROFESSOR MARTIN. Three times weekly, Tuesday, Wednesday, and Thursday, 11 a. m. (13).

Buckler.	Kastle.	Price.	Wightman.
Hartogensis.	McIntosh.	Smith, W. F.	Williams, J. W.
Hemmeter.	Nuttall.	Stein.	Winslow.
Herrick.			

History of Morphology: DR. BROOKS. Three times weekly, Monday, Wednesday, and Friday, 5 p. m. (7).

Andrews.	Haldeman.	Nelson.	Wilson.
Bruce.	Herrick.	Orr.	

Advanced Morphology: (*Laboratory Work*): DR. BROOKS. Daily. (7).

Andrews.	Haldeman.	Nelson.	Wilsen.
Bruce.	Herrick.	Orr.	

Physiology of Respiration: DR. HOWELL. Weekly, Monday, 12 m. (8).

Campbell, J. P.	Haldeman.	Herrick.	Nelson.
Donaldson.	Hemmeter.	Kemp.	Nuttall.

Osteology: DR. MCMURRICH. Twice weekly, Tuesday and Thursday, 10 a. m. (18).

Allen, P.	Gooch.	Reeve.	Straus.
Applegarth, E. C.	Lamb.	Shemwell.	Swartz.
Coates.	O'Donovan.	Smith, A. D.	Williams, L. E.
Dreyer.	Pope.	Stow.	Willis.
Friedenwald.	Reese.		

Mammalian Anatomy: DR. MCMURRICH. Twice weekly, Monday and Friday, 11 a. m. (9).

Buckler.	McIntosh.	Stein.	Williams, J. W.
Hartogensis.	Smith, W. F.	Wightman.	Winslow.
Kastle.			

Laboratory Work: PROFESSOR MARTIN, DR. BROOKS, DR. HOWELL, and DR. MCMURRICH. Daily, 9 a. m. to 5 p. m. (44).

Abbott.	Friedenwald.	Miller, O. C.	Smith, W. F.
Allen, P.	Gooch.	Nelson.	Stein.
Andrews.	Haldeman.	Nixen.	Stow.
Applegarth, E. C.	Hartogensis.	Nuttall.	Straus.
Bruce.	Hemmeter.	O'Donovan.	Swartz.
Buckler.	Herrick.	Orr.	Wightman.
Campbell, J. P.	Jastrow.	Pope	Williams, J. W.
Chandlee.	Kastle.	Reese.	Williams, L. E.
Coates.	Kemp.	Reeve.	Willis.
Dreyer.	Lamb.	Shemwell.	Wilson.
Duggan.	McIntosh.	Smith, A. D.	Winslow.

Greek. (40 Students).

Classes meet in 181 N. Howard St.

Greek Seminary: (*Plato*): PROFESSOR GILDERSLEEVE. Twice weekly, Monday and Wednesday, 10 a. m. (23).

Botsford.	Huizinga.	Patrick.	Smith, K. W.
Christie.	Hussey.	Pease.	Steele.
Doubleday.	Lodge.	Peirson.	Stetson.
Elliott, E. S.	Magoun.	Ramsay.	Trueman.
Elmer.	Milroy.	Scribner.	Walz.
Fossum.	Murray, A. T.	Slaughter.	

Greek Syntax: (*Hypotactic Sentence in Greek*): PROFESSOR GILDERSLEEVE. Weekly, Thursday, 10 a. m. (25).

Botsford.	Huizinga.	Murray, A. T.	Slaughter.
Christie.	Hussey.	Patrick.	Smith, K. W.
Doubleday.	Lodge.	Pease.	Steele.
Elliott, E. S.	Magoun.	Peirson.	Stetson.
Elmer.	Milroy.	Ramsay.	Trueman.
Fossum.	Moore, J. L.	Scribner.	Walz.
Grier.			

Practical Exercises: PROFESSOR GILDERSLEEVE. Twice weekly, Tuesday and Friday, 10 a. m. (22).

Botsford.	Huizinga.	Murray, A. T.	Smith, K. W.
Christie.	Hussey.	Patrick.	Steele.
Doubleday.	Lodge.	Peirson.	Stetson.
Elliott, E. S.	Magoun.	Ramsay.	Trueman.
Elmer.	Milroy.	Scribner.	Walz.
Fossum.	Moore, J. L.		

Demosthenes: *De Corona:* PROFESSOR MORRIS. Four times weekly, Tuesday, Wednesday, Thursday, and Friday, 12 m. (8).

Bruyn.	Flexner.	Hoffmann.	Rogers.
Cole.	Grier.	McLane, R. M.	Thompson.

Xenophon: *Oeconomicus:* DR. SPIEKER. Four times weekly, Tuesday, Wednesday, Thursday, and Friday, 11 a. m. (9).

Bechtel.	Gildersleeve, R. C.	Loob.	Rosenthal.
Bruyn.	Helfenstein.	Palmer, O. H.	Rowland, A. J.
Devries.			

Prose Composition:

Class A: PROFESSOR MORRIS. Weekly, Monday, 12 m. (8).

Bruyn.	Flexner.	Hoffmann.	Rogers.
Cole.	Grier.	McLane, R. M.	Thompson.

Class B: DR. SPIEKER. Weekly, Monday, 11 a. m. (9).

Bechtel.	Gildersleeve, R. C.	Loeb.	Rosenthal.
Bruyn.	Helfenstein.	Palmer, O. H.	Rowland, A. J.
Devries.			

Greek Dialects and Inscriptions: DR. SMYTH. Weekly, Thursday, 12 m. (12).

Botsford.	Hussey.	Milroy.	Steele.
Christie.	Lodge.	Murray, A. T.	Trueman.
Elliott, E. S.	Magoun.	Scribner.	Walz.

Latin. (71 Students).

Classes meet in 181 N. Howard St.

Seminary: (*Livy and Tacitus*): DR. WARREN. Twice weekly, Tuesday and Friday, 11 a. m. (24).

Botsford.	Fontaine.	Moore, J. L.	Slaughter.
Bowen.	Fossum.	Murray, A. T.	Smith, K. W.
Christie.	Hussey.	Pease.	Steele.
Doubleday.	Jones, C. E.	Peirson.	Stetson.
Elliott, E. S.	Magoun.	Scribner.	Trueman.
Elmer.	Milroy.	Shefloe.	Walz.

Roman Historians: DR. WARREN. Weekly, Monday, 11 a. m. (25).

Botsford.	Fossum.	Moore, J. L.	Slaughter.
Bowen.	Hussey.	Murray, A. T.	Smith, K. W.
Christie.	Jones, C. E.	Pease.	Steele.
Doubleday.	Lodge.	Peirson.	Stetson.
Elliott, E. S.	Magoun.	Scribner.	Trueman.
Elmer.	Milroy.	Shefloe.	Walz.
Fontaine.			

Reading at Sight: DR. WARREN. Weekly, Thursday, 11 a. m. (15).

Botsford.	Fossum.	Scribner.	Stetson.
Christie.	Hussey.	Shefloe.	Trueman.
Elliott, E. S.	Milroy.	Smith, K. W.	Walz.
Fontaine.	Murray, A. T.	Steele.	

Plautus and Terence: DR. WARREN. Three times weekly, Tuesday, Thursday, and Friday, 10 a. m. (6).

Cole.	McLane, R. M.	Preston.	Thompson.
Flexner.	McPherson.		

Reading at Sight: DR. WARREN. Weekly, Wednesday, 10 a. m. (6).

Cole.	McLane, R. M.	Preston.	Thompson.
Flexner.	McPherson.		

Cicero, *De Natura Deorum:* ***Lucretius,*** *bks. i, iii:* PROFESSOR MORRIS. Three times weekly, Tuesday, Thursday, and Friday, 10 a. m. (3).

Bruyn.	Hoffmann.	Rogers.

Reading at Sight: PROFESSOR MORRIS. Weekly, Wednesday, 10 a. m. (3).

Bruyn.	Hoffmann.	Rogers.

Livy, *bks. v and vi:* DR. SPIEKER. Four times weekly, Tuesday, Wednesday, Thursday, and Friday, 9 a. m. (21).

Bayard.	Gildersleeve, R. C.	Loeb.	Rowland, A. J.
Bechtel.	Gordon.	Palmer, O. H.	Tarleton.
Black.	Hahn.	Poullain.	Taylor, R. T.
Brown, H. M.	Helfenstein.	Reader.	Willoughby, W. F.
Daish.	Hilles.	Rosenthal.	Willoughby, W. W.
Devries.			

Prose Composition:

Class A: DR. WARREN. Weekly, Monday, 10 a. m. (6).

Cole.	McLane, R. M.	Preston.	Thompson.
Flexner.	McPherson.		

Class B: PROFESSOR C. D. MORRIS. Weekly, Monday, 10 a. m. (3).

Bruyn.	Hoffmann.	Rogers.

Class C: DR. SPIEKER. Weekly, Monday, 9 a. m. (12).

Bechtel.	Gildersleeve, R. C.	Palmer.	Rowland, A. J.
Brown, A. M.	Helfenstein.	Poullain.	Tarleton.
Devries.	Loeb.	Rosenthal.	Taylor, R. T.

Supplementary Class: MR. SLAUGHTER. Three times weekly, Monday, Wednesday, and Friday, 4 p. m. (13).

Bolgiano.	Dorr.	Fearn.	Reeves.
Boyd.	Dorsey.	Lanier.	Stow.
Chisolm.	Duvall.	Patterson.	Taylor, F. W.
Cradock.			

Shemitic Languages. PROFESSOR HAUPT. (14 Students).

Classes meet in 111 W. Monument St.

Elementary Hebrew: (*Gesenius-Mitchell's Grammar; Genesis, ed. Baer*). Weekly, Thursday, 4 p. m. (12).

Adler.	Cole.	Milroy.	Rogers.
Allen, E. P.	Grier.	Mossell.	Schloegel.
Bevan.	Huizinga.	Ramsay.	Walz.

Hebrew Exercises: (*Historical Books*). Weekly, Wednesday, 4 p. m. (7).

Adler.	Huizinga.	Ramsay.	Schloegel.
Allen, E. P.	Milroy.	Rogers.	

Biblical Aramaean: (*Ezra*). Weekly, Wednesday, 3 p. m. (4).

Adler.	Huizinga.	Ramsay.	Schloegel.

Syriac for beginners: (*Noeldeke's Grammar, Nestle's Chrestomathy*). Weekly, Tuesday, 3–5 p. m. (4).

Adler.	Huizinga.	Ramsay.	Schloegel.

Arabic: (*Voyages of Sindbad*). Weekly, Wednesday, 11 a. m. (4).

Adler.	Huizinga.	Phillpson.	Schloegel.

Ethiopic: (*Dillmann's Chrestomathy*). Weekly, Wednesday, 10 a. m. (4).

Adler.	Huizinga.	Phillpson.	Schloegel.

Assyrian: (*Annals of Sennacherib*). Weekly, Thursday, 11 a. m. (5).

Adler.	Huizinga.	Philipson.	Schloegel.
Frothingham.			

Sumero-Akkadian: (*Bilingual Hymns and Psalms*). Weekly, Thursday, 12 m. (5).

Adler.	Huizinga.	Phillpson.	Schloegel.
Frothingham.			

Babylonian: (*Inscriptions of Nebuchadnezzar*). Weekly, Thursday, 3 p. m. (5).

Adler.	Huizinga.	Philipson.	Schloegel.
Frothingham.			

Sanskrit and the comparative grammar of the cognate languages. DR. BLOOMFIELD. (31 Students).

Classes meet in 111 W. Monument St.

Elementary Sanskrit: (*Whitney's Grammar and Lanman's Reader*). Twice weekly, Tuesday and Friday, 12 m. (12).

Hempl.	Murray, A. T.	Ramsay.	Smith, K. W.
Magoun.	Patrick.	Schloegel.	Steele.
Moore, J. L.	Pease.	Scribner.	Stetson.

Advanced Sanskrit: (*Selections from Classical Sanskrit: Rig-Veda*). Twice weekly, Wednesday 11 a. m., Friday 3 p. m. (8).

Christie.	Fossum.	Lodge.	Stetson.
Doubleday.	Hussey.	Milroy.	Walz.

Atharva-Veda and Kauçika-sutra. Weekly, Saturday, 11 a. m. (2).

Smyth, H W.	Spieker.

Comparative Philology: (*Lectures: Whitney's Language and the Study of Language*). Weekly, Monday, 12 m. (18).

Bevan.	Hough.	Murray, A. T.	Smith, K. W.
Bowen.	Hughes.	Pelrson.	Steele
Flexner.	Lodge.	Ramsay.	Stetson.
Harry.	Magoun.	Scribner.	Trueman.
Hodges.	Moore, J. L.		

Comparative Grammar of Greek: (*Brugmann's Griechische Grammatik*). Weekly, Thursday, 3 p. m. (19).

Christie.	Lodge.	Patrick.	Steele.
Doubleday.	Magoun.	Pelrson.	Stetson.
Fossum.	Milroy.	Ramsay.	Trueman.
Huizinga.	Moore, J. L.	Scribner.	Walz.
Hussey.	Murray, A. T.	Smith, K. W.	

Lectures on Indo-European Noun Composition. (14).

Christie.	Lodge.	Ramsey.	Steele.
Doubleday.	Magoun.	Scribner.	Stetson.
Fossum.	Milroy.	Smith, K. W.	Walz.
Hussey.	Patrick.		

German. (111 Students).

Classes meet in 111 and 117 W. Monument St.

German Seminary: DR. WOOD. Twice weekly, Monday and Friday, 10 a. m. (7).

Burton.	Egge.	Hubbard.	Matzke.
Dunlap.	Hempl.	Learned.	

Gothic: (*Braune's Grammar; Bernhardt's Kurzgefasste Gotische Grammatik*): DR. WOOD. Twice weekly, Monday and Wednesday, 9 a. m. (7).

Crenshaw.	Hall, J. L.	Smyth, A. H.	Wightman, J. R.
Cummings.	Hench.	Whetham.	

Old Norse: (*Brenner, Altnordisches Handbuch*): DR. WOOD. Twice weekly, Tuesday and Friday, 9 a. m. (6).

Burton.	Dunlap.	Hubbard.	Learned.
Crenshaw.	Egge.		

Old Teutonic Life: (*Lectures*): DR. WOOD. Weekly, Wednesday, 12 m. (13).

Bright.	Egge.	Hubbard.	Smyth, A. H.
Burton.	Edmiston.	Learned.	Whetham.
Crenshaw.	Hempl.	Matzke.	Wightman.
Dunlap.			

(*Major Course*).

German Literature: (*Lectures, with Kluge's Geschichte d. deutschen Literatur*): DR. GOEBEL. Weekly, Wednesday, 10 a. m. (12).

Allen, E. P.	Cummings.	Jones, C. E.	Tuska.
Boyd.	Edmiston.	Shefloe.	Wiesenfeld.
Crenshaw.	Gorton.	Smyth, A. H.	Young.

Middle High German: (*Paul's Grammar; Weinhold's Reader*): DR. WOOD. Weekly, Tuesday, 10 a. m. (5).

Allen, E. P.	Dunlap.	Edmiston.	Smyth, A. H.
Crenshaw.			

Selected Readings: (*Masius's Lesebuch, iii*): DR. GOEBEL. Weekly, Tuesday, 10 a. m. (8).

Boyd.	Ramsay.	Roberts, B. T.	Wiesenfeld.
Cummings.	Sanford.	Shefloe.	Young.

Goethe: *Hermann und Dorothea:* DR. GOEBEL. Twice weekly, Monday and Thursday, 10 a. m. (10).

Allen, E. P.	Cummings.	Roberts, B. T.	Smyth, A. H.
Boyd.	Edmiston.	Shefloe.	Wiesenfeld.
Crenshaw.	Jones, C. E.		

Prose Composition: MR. HEMPL. Weekly, Friday, 10 a. m. (12).

Allen, E. P.	Cummings.	Jones, C. E.	Tuska.
Boyd.	Edmiston.	Roberts, B. T.	Wiesenfeld.
Crenshaw.	Gorton.	Smyth, A. H.	Young.

German Style and Syntax: DR. GOEBEL. Second Monday in each month, 3 p. m. (5).

Allen, E. P.	Jones, C. E.	Shefloe.	Young.
Boyd.			

(*Minor Course*).

Lessing: *Minna von Barnhelm:* MR. HEMPL. Weekly, Monday, 11 a. m. (32).

Allen, P.	Dorsey.	Jones, W.	Pope.
Black.	Duvall.	Lamb.	Preston.
Brigham.	Ensey.	Lanier.	Reeves.
Browne, A. L.	Ferguson.	Meriwether.	Swartz.
Carey.	Ferris.	Macauley.	Taylor, F. W.
Chisolm.	Hahn.	Miller, W. H.	White.
Daish.	Hughes.	O'Donovan.	Willoughby, W. F.
Dashiell.	Hall, J. L.	Ota.	Willoughby, W. W.

Goethe: *Egmont:* DR. GOEBEL. Twice weekly, Monday and Thursday, 2 p. m. (5).

Crenshaw.	Preston.	Ramsay.	Reeves.
Fergusou.			

Historical Readings: DR. GOEBEL. Twice weekly, Tuesday and Friday, 11 a. m. (18).

Ayres.	Daish.	Meriwether.	Sanford.
Black.	Ferris.	Ota.	Wiesenfeld.
Burnham.	Hahn.	Ramsay.	Willoughby, W. F.
Dorsey.	Hughes.	Randall, D. R.	Willoughby, W. W.
Duvall.	Lanier.		

Scientific Readings: MR. HEMPL. Twice weekly, Tuesday and Friday, 11 a. m. (20).

Allen, P.	Dashiell.	Miller, W. H.	Pope.
Brigham.	Ensey.	Macauley.	Reese.
Browne, A. L.	Hixson.	O'Donovan.	Swartz.
Carey.	Jones, W.	Patrick.	Taylor, F. W.
Chisolm.	Lamb.	Pennlman.	White.

Oral Practice: MR. HEMPL. Weekly, Thursday, 11 a. m. (38).

Allen, P.	Duvall.	Lamb.	Preston.
Black.	Ensey.	Lanier.	Ramsay.
Brigham.	Ferguson.	Macauley.	Reeves.
Browne, A. L.	Ferris.	Merlwether.	Swartz.
Burnham.	Hall, J. L.	Miller, W. H.	Taylor, F. W.
Carey.	Hahn.	O'Donovan.	White.
Chisolm.	Hench.	Penniman.	Williams, W. K.
Daish.	Hixson.	Peirson.	Willoughby, W. F.
Dashiell.	Hughes.	Pope.	Willoughby, W. W.
Dorsey.	Jones, W.		

Prose Composition: MR. HEMPL. Weekly, Wednesday, 11 a. m. (35).

Allen, P.	Ensey.	Macauley.	Reeves.
Black.	Ferguson.	Merlwether.	Sanford.
Brigham.	Ferris.	Miller, W. H.	Stow.
Browne, A. L.	Hahn.	O'Donovan.	Taylor, F. W.
Carey.	Hall, J. L.	Penniman.	White.
Daish.	Hughes.	Peirson.	Williams, W. K.
Dashiell.	Jones, W.	Pope.	Willoughby, W. F.
Dorsey.	Lamb.	Preston.	Willoughby, W. W.
Duvall.	Lanier.	Ramsay.	

German Conversation: DR. GOEBEL. Daily, 9 a. m. (17).

Allen, E. P.	Flexner.	Hubbard.	Smyth, A. H.
Burnham.	Gardner.	Jones, C. E.	Wiegand.
Burton.	Hench.	Roberts, B. T.	Wiesenfeld.
Crenshaw.	Horner.	Sato.	Woods.
Edmiston.			

Supplementary Classes:

Section I: MR. HEMPL. Monday, Wednesday, and alternate Fridays, 5 p. m. (11).

Belgiano.	Geoch.	Moore, G. N.	Warren.
Cradock.	Hilles.	Reader.	Williams, L. E.
Gilpin.	Jones, H. C.	Shemwell.	

Section II: MR. HEMPL. Daily, 3 p. m. (29).

Bayard.	Engle.	Jones, W. A.	Rouse.
Blandin.	Grier.	Linn.	Rowland, A. J.
Brill.	Haight.	McCabe.	Taylor, R. T.
Brown, H. M.	Hodges.	McLane, R. M.	Tarleton.
Bruyn.	Hench.	McWhirter.	Thompson.
Campbell, G. M.	Herrick.	Milroy.	Trueman.
Cole.	Hixson.	Rogers.	Williams, W. K.
Elliott, E. S.			

Romance Languages. (61 Students).

Classes meet in 111 and 117 W. Monument St.

Advanced Courses: (*French Phonology; Romance Morphology*). MR. ELLIOTT. (Two classes). Monday, 10 and 11 a. m. (12).

Crenshaw.	Gerber.	Matzke.	Reeves.
Cummings.	Hench.	McCabe.	Whetham.
Edmiston.	Learned.	Perkins, C. A.	Wightman, J. R.

Advanced Courses: (*Romance Seminary; Old French Syntax*; *Italian Dialects*): MR. ELLIOTT. (Three classes). Wednesday, 10, 11 a. m.; Thursday, 10, 11 a. m. (7).

Bowen.	Gerber.	Perkins, C. A.	Wightman, J. R.
Fontaine.	Matzke.	Whetham.	

Advanced Courses: (*Romance Studies in Europe; Langue d'Oïl Dialects*): MR. ELLIOTT. (Two classes). Tuesday, 10, 11 a. m. (9).

Edmiston.	Learned.	McCabe.	Whetham.
Egge.	Matzke.	Perkins, C. A.	Wightman, J. R.
Gerber.			

Italian: DR. TODD. Three times weekly, Monday, Tuesday, and Wednesday, 9 a. m. (5).

Christie.	Lodge.	Shefloe.	Warner.
Edmiston.			

Spanish: DR. TODD. Twice weekly, Thursday and Friday, 9 a. m. (9).

Edmiston.	Gerber.	McCabe.	Whetham.
Egge.	Laessig.	Reeves.	Wightman, J. R.
Fossum.			

Portuguese and Old Provencal: DR. TODD. Twice weekly, Tuesday and Friday, 4 p. m. (4).

Matzke.	McCabe.	Whetham.	Wightman, J. R.

French: Major Course: DR. TODD and MR. FONTAINE. Daily, 10 a. m. (10).

Bowen.	Edmiston.	Laessig.	Whetham.
Crenshaw.	English.	Reeves.	Wightman, J. R.
Cummings.	Hench.		

French: Minor Course: DR. TODD, MR. FONTAINE, MR. BOWEN. Daily, 12 m. (16).

Brune.	Dorsey.	Friedenwald.	Stein.
Chisolm.	Dreyer.	Guggenheimer.	Warren.
Crenshaw.	Edmiston.	Harry.	Weech.
Dashiell.	Ferguson.	Tuska.	White.

French Pronunciation and Conversation: MR. FONTAINE. Four times weekly, Tuesday and Thursday, 3 p. m., Friday, 12 m., and Saturday, 9 a. m. (25).

Bowen.	Harry.	Lodge.	Stein.
Carey.	Hoffmann.	Macauley.	Stevens.
Christie.	Hench.	Matzke.	Warren.
Crenshaw.	Jones, C. E.	Moore, G. N.	Whetham.
Edmiston.	Laessig.	Reeves.	Wiegand.
Fossum.	Learned.	Shefloe.	Wightman.
Gerber.			

Supplementary Class: MR. BOWEN. Three times weekly, Tuesday, Thursday, and alternate Fridays, 5 p. m. (22).

Ballard.	Ferris.	Jones, W.	Poullain.
Belgiano.	Flexner.	Linn.	Sanford.
Brigham.	Gilpin.	Macauley.	Shefloe.
Carey.	Hahn.	Moore, G. N.	Shemwell.
Cradock.	Hixson.	O'Donovan.	Van Vleck.
Eareckson.	Hough.		

The advanced students of the Romance Languages meet as an association fortnightly.

Bowen.	Egge.	Learned.	Reeves.
Crenshaw.	Fontaine.	Matzke.	Whetham.
Cummings.	Gerber.	McCabe.	Wightman, J. R.
Edmiston.	Hench.	Perkins, C. A.	

English. (54 Students).

Classes meet in 111 and 117 W. Monument St,

Old English Texts: (*Orosius*): DR. BRIGHT. Twice weekly, Tuesday and Thursday, 4 p. m. (8).

Burton.	Egge.	Hempl.	Hubbard.
Dunlap.	Hall, J. L.	Hench.	Smyth, A. H.

Historical English Grammar: DR. BRIGHT. Twice weekly, Wednesday and Friday, 4 p. m. (10).

Burton.	Egge.	Hench.	Learned.
Cummings.	Hall, J. L.	Hubbard.	Smyth, A. H.
Dunlap.	Hempl.		

English Seminary: DR. BRIGHT. Alternate Fridays, 8 p. m. (11).

Burton.	Egge.	Hench.	Learned.
Cummings.	Hall, J. L.	Hubbard.	Smyth, A. H.
Dunlap.	Hempl.	Katzenstein.	

(*Major Course*).

First English Literature: DR. BRIGHT. Weekly, Monday, 12 m. (8).

Allen, E. P.	Egge.	Hench.	Smyth, A. H.
Cummings.	Hall, J. L.	Hubbard.	Wightman, J. R.

Early English: (*Morris: Specimens of Early English I*). MR. EGGE. Twice weekly, Tuesday and Thursday, 12 m. (3).

Cummings.	Hall, J. L.	Shefloe.	

Modern English Literature: DR. BROWNE. Weekly, Friday, 12 m. (2).

Brackett, J. R.	Shefloe.		

(*Minor Course*).

Anglo-Saxon: DR. BRIGHT. Weekly, Wednesday, 11 a. m. (12).

Allen, E. P.	Edmiston.	Poullain.	Tarleton.
Burnham.	Hall, J. L.	Shefloe.	Whetham.
Cummings.	Hamilton.	Smyth, A. H.	Wightman, J. R.

Elements of Phonetics: DR. BRIGHT. Weekly, Monday, 11 a. m. (7).

Allen, E. P.	Dunlap.	Hubbard.	Tarleton.
Cummings.	Hench.	Poullain.	

Elizabethan and Eighteenth Century Literature: DR. BROWNE. Three times weekly, Tuesday, Thursday, and Friday, 11 a. m. (4).

Hamilton.	Poullain.	Shefloe.	Tarleton.

English Literature: (*P. H. E. Course*): DR. BROWNE. Twice weekly, Wednesday and Thursday, 12 m. In College Hall. (35).

Ballard.	Devries.	Jones, W.	Reader.
Bechtel.	Dorr.	Lanier.	Rosenthal.
Black.	Duvall.	Loeb.	Simon.
Boyd.	Fearn.	Macauley.	Tarleton.
Brigham.	Ferris.	Mann.	Taylor, F. W.
Brown, H. M.	Forrest.	Miller, W. H.	Taylor, R. T.
Browne, A. L.	Gildersleeve.	Moore, G. N.	Willoughby, W. F.
Carey.	Hahn.	Patterson.	Willoughby, W. W.
Daish.	Hilles.	Poullain.	

History and Political Science. (97 Students).

Classes meet in the rooms of the Bluntschli Library.

Seminary of History and Politics: DR. ADAMS. Weekly Friday, 8 p. m. (21).

Applegarth, A. C.	Egge.	Katzenstein.	Sanford.
Ayres.	Fisher.	Langdon.	Sato.
Bliss.	Gardner.	Newton.	Sloan.
Brackett, J. R.	Holcomb.	Ota.	Warner.
Davis.	Jones, C. E.	Randall, D. R.	Williams, L.
Dewey.			

History of Politics: DR. ADAMS. Twice weekly, Wednesday and Thursday, 11 a. m. (23).

Applegarth, A. C.	Egge.	Moore, J. L.	Sams.
Ayres.	Fisher.	Newton.	Sato.
Berry.	Gardner.	Ota.	Steiner.
Boston.	Holcomb.	Pleasants, R. H.	Warner.
Brackett, J. R.	Jones, C. E.	Poe.	Williams, L.
Dewey.	Katzenstein.	Randall, D. R.	

Church History: Dr. Adams. Twice weekly, Monday and Tuesday, 11 a. m. (18).

Ayres.	Fifield.	Jones, W. A.	Rouse.
Bliss.	Forrest.	Mansfield.	Tuska.
Brune.	Gordon.	Patterson.	Warner.
Davis.	Guggenheimer.	Roberts, B. T.	Young.
Devries.	Heffmann.		

International Law: Dr. Adams. Twice weekly, Monday and Tuesday, 12 m. (14).

Ayres.	Doub.	Ota.	Williams, W. K.
Bayard.	Fifield.	Pleasants, R. H.	Woods.
Bliss.	Jones, C. E.	Williams, L.	Young.
Davis.	Meriwether.		

Ante-classical History: (*P. H. E. Course*): Dr. Adams. Weekly, Friday, 12 m. (42).

Allen, E. P.	Chisolm.	Jones, C. E.	Reader.
Allen, P.	Daish.	Jones, W.	Rosenthal.
Ballard.	Devries.	Lanier.	Simon.
Bechtel.	Dorr.	Loeb.	Swartz.
Black.	Duvall.	Macauley.	Tarleton.
Bolgiano.	Eosey.	Mann.	Taylor, F. W.
Boyd.	Fearn.	Miller, W. H.	Taylor, R. T.
Brigham.	Forrest.	Moore, G. N.	Warner.
Brown, H. M.	Gildersleeve.	Patterson.	Willoughby, W. F.
Browne, A. L.	Hahn.	Poullain.	Willoughby, W. W.
Carey.	Hilles.		

Studies in Administration: Dr. Ely. Weekly, Friday, 10 a.m. (14).

Applegarth, A. C.	Ferguson.	Randall, D. R.	Sato.
Ayres.	Gardner.	Sams.	Steiner.
Burnham.	Holcomb.	Sanford.	Warner.
Dewey.	Ota.		

Advanced Political Economy: Dr. Ely. Twice weekly, Wednesday and Thursday, 10 a. m. (16).

Applegarth, A. C.	Dewey.	Katzenstein.	Sanford.
Ayres.	Ferguson.	Ota.	Sato.
Berry.	Gardner.	Randall, D. R.	Steiner.
Burnham.	Holcomb.	Sams.	Warner.

Elements of Political Economy: (*Minor Course*): Dr. Ely. Daily, 1 p. m. (16).

Bliss.	Gordon.	McLane, A.	Rouse.
Brune.	Guggenheimer.	McPherson.	Sloan.
Davis.	Horner.	Preston.	Tuska.
Dorsey.	Jones, W. A.	Roberts, B. T.	Willis.

English and French History: Dr. Jameson. Three times weekly, Wednesday, Thursday, and Friday, 11 a. m. (12).

Bliss.	Fifield.	Guggenheimer.	Roberts, B. T.
Brune.	Forrest.	Jones, W.	Rouse.
Davis.	Gordon.	Patterson.	Tuska.

English Constitution: Dr. Jameson. Three times weekly, Wednesday, Thursday, and Friday, 12 m. (15).

Applegarth, A. C.	Boston.	Meriwether.	Williams, W. K.
Bayard.	Davis.	Pleasants, R. H.	Woods.
Bevan.	Doub.	Poe.	Young.
Bliss.	Fifield.	Williams, L.	

Greek and Roman History: (*P. H. E. Course*): Dr. Jameson. Twice weekly, Monday and Tuesday, 12 m. (34).

Ballard.	Carey.	Hahn.	Reader.
Bechtel.	Cradock.	Hilles.	Rosenthal.
Black.	Daish.	Jones, W.	Simon.
Bolgiano.	Dorr.	Lanier.	Tarleton.
Boyd.	Duvall.	Loeb.	Taylor, F. W.
Brigham.	Fearn.	Miller, W. H.	Taylor, R. T.
Bromwell.	Ferris.	Patterson.	Willoughby, W. F.
Brown, H. M.	Forrest.	Poullain.	Willoughby, W. W.
Browne, A. L.	Gildersleeve.		

Herodotus (*in Translation*): Professor Morris. Weekly, Monday, 9 a. m. (10).

Applegarth, A. C.	Daish.	Hilles.	Willoughby, W. F.
Bayard.	Gordon.	Reader.	Willoughby, W. W.
Black.	Hahn.		

General European History: (*P. H. E. Course*): Mr. Holcomb. Twice weekly, Monday and Tuesday, 12 m. (6).

Allen, P.	Macauley.	O'Donovan.	Moore, G. N.
Devries.	Mann.		

Psychology and Pedagogics. Professor Hall. (49 Students).

History of Philosophy. Weekly, Monday, 12 m., 113 W. Monument St. (26).

Adler.	Fields.	Mansfield.	Pease.
Botsford.	Fisher.	Milroy.	Quincy.
Burnham.	Gardner.	Newton.	Sanford.
Burton.	Hixson.	Nixon.	Slaughter.
Christie.	Horner.	Nuttall.	Walz.
Crowell.	Hussey.	Patrick.	Wiesenfeld.
Elliott, E. S.	Jastrow.		

Psychology. Weekly, Wednesday, 12 m., Biological Laboratory. (16).

Adler.	Donaldson.	Horner.	Nixon.
Bruce.	Haight.	Jastrow.	Noyes.
Burnham.	Hemmeter.	Mansfield.	Quincy.
Crowell.	Hixson.	Nelson.	Sanford.

Education. Weekly, Friday, 12 m., Biological Laboratory. (36).

Adler.	Egge.	Horner.	Nelson.
Bell, L.	Fields.	Hubbard.	Palmer, C. S.
Bliss.	Fisher.	Hussey.	Quincy.
Botsford.	Gardner.	Jastrow.	Sanford.
Bowen.	Haight.	Katzenstein.	Slaughter.
Burnham.	Hayes.	Kemp.	Whetham.
Campbell, G. M.	Hemmeter.	Mansfield.	Wiesenfeld.
Christie.	Hixson.	Milroy.	Wightman, J. R.
Crowell.	Holcomb.	McWhirter.	Woodhull.

Histology of Sense Organs: Dr. Donaldson. Weekly (hours will be announced later.) (5).

Bruce.	Jastrow.	Nuttall.	Sanford.
Crowell.			

Introductory to Psychology [*Biology*]: Dr. Donaldson. Weekly, Tuesday, 12 m. (6).

Burnham.	Hixson.	Mansfield.	Sanford.
Crowell.	Jastrow.		

The following students are engaged in psycho-physical experiments.

Donaldson.	Jastrow.	Nixon.	Quincy.
Haight.	Nelson.		

The Ethical Club meets at 113 Monument St., Wednesday, 8 p. m. (8).

Burnham.	Fisher.	Mansfield.	Quincy.
Crowell.	Hixson.	Patrick.	Sanford.

Seminary [psycho-physics] meets weekly, Monday, 8 p. m. (6).

Donaldson.	Hartwell.	Noyes.	Quincy.
Hemmeter.	Jastrow.		

Logic. (*L. E. P. Course*). Professor Morris. Daily, 1 p. m. (28).

Applegarth, E. C.	English.	Hughes.	Williams, J. W.
Bevan.	Flexner.	Laessig.	Williams, L.
Buckler.	Gorton.	Mertwether.	Williams, W.
Coates.	Harry.	Pleasants, R. H.	Wingert.
Dehme.	Hartegensis.	Smith, W. F.	Winslow.
Duffy.	Hodges.	Stein.	Woods.
Eichelberger.	Hough.	Weech.	Young.

Elocution. (52 Students).

Mr. Woodworth. Daily, 9 a. m. to 12.30 p. m.

Ames.	Carey.	Helfenstein.	Palmer, O. H.
Ayres.	Daish.	Hixson.	Reader.
Ballard.	Dashiell.	Hodges.	Reeves.
Bechtel.	Devries.	Hoffmann.	Shemwell.
Bevan.	Dreyer.	Jones, C. E.	Stew.
Black.	Duvall.	Jones, W.	Tarleton.
Boyd.	Fearn.	Macauley.	Thompson.
Brigham.	Flexner.	McLane, R. M.	Weech.
Bromwell.	Forrest.	McPherson.	White.
Browne, A. L.	Gildersleeve.	Meriwether.	Williams.
Buckler.	Gilpin.	Miller, W. H.	Willoughby, W. F.
Brune.	Gordon.	Moore, G. N.	Willoughby, W. W.
Burnham.	Grier.	O'Donovan.	Young.

Drawing. Mr. Newell. (64 Students).

Free-Hand Drawing. Daily (except Wednesday), 1 p. m. (60).

Ballard.	Ferris.	McMurrich.	Simon.
Black.	Flexner.	McPherson.	Stein.
Bolgiano.	Forrest.	Mann.	Stew.
Boyd.	Friedenwald.	Meriwether.	Taylor, F. W.
Brigham.	Gildersleeve.	Miller, W. H.	Taylor, R. T.
Bromwell.	Glenn.	Moore, G. N.	Thompson.
Browne, A. L.	Gordon.	O'Donovan.	Weech.
Brune.	Guggenheimer.	Palmer, O. H.	White.
Buckler.	Harry.	Randall, D. R.	Wiegand.
Carey.	Hodges.	Reader.	Wightman, A. C.
Chisolm.	Heffmann.	Reeves.	Wilson.
Dashiell.	Heugh.	Roberts, B. T.	Williams.
Dorr.	Hughes.	Roberts, D. E.	Wingert.
Dreyer.	Jones, W.	Rowland, A. J.	Winslow.
Duffy.	Macauley.	Shemwell.	Young.

Mechanical Drawing. (7).

Class I. Saturday, at 2 p. m.

Laessig.	Ensey.

Class II. Saturday, at 2 p. m.

Dehme.	Macauley.	Reese.	Wiegand.
Glenn.			

Perspective Drawing. (45).

Class I. Saturdays at 1 p. m.

Brigham.	Flexner.	Mann.	Stein.
Dashiell.	Hoffmann.	Reeves.	Weech.
Duffy.	Laessig.	Simon.	Williams.
Ensey.			

Class II. Thursday, at 1 p. m.

Black.	Carey.	Friedenwald.	Reader.
Belgiano.	Duffy.	Moore, G. N.	Rowland, A. J.
Bromwell.	Fifield.	Palmer, O. H.	Weech.

Class III. Thursday, at 3 p. m.

Ballard.	Ferrest.	Hughes.	Wiegand.
Brigham.	Guggenheimer.	Jones, W.	White.
Browne.	Harry.	Miller, W. H.	Wightman, A. C.
Brune.	Hodges.	Taylor, F. W.	Wingert.
Ferris.	Hough.	Taylor, R. T.	Young.
Flexner.			

HOURS FOR LECTURES AND RECITATIONS, FIRST HALF-YEAR, 1885-86.

HOURS.	MONDAY.	TUESDAY.	WEDNESDAY.	THURSDAY.	FRIDAY.	SATURDAY.
A. M.	Carbon Compounds. (Remsen.) Latin Prose. (Spieker.)	Carbon Compounds. (Remsen.) Livy. (Spieker.) Astronomy. (Newcomb.)	General Chemistry. (Remsen.) Livy. (Spieker.)	General Chemistry. (Remsen.) Livy. (Spieker.) Astronomy. (Newcomb.)	General Chemistry. (Remsen.) Livy. (Spieker.)	
9	Italian. (Todd.) Gothic. (Wood.) Herodotus. (Morris.) Mineralogy: Elem. (Williams.) German Conversation. (Goebel.) Elocution. (Woodworth.)	Italian. (Todd.) Old Norse. (Wood.) German Conversation. (Goebel.) Elocution. (Woodworth.)	Italian. (Todd.) Gothic. (Wood.) German Conversation. (Goebel.) Elocution. (Woodworth.)	Spanish. (Todd.) Theoretical Chemistry. (Morse.) German Conversation. (Goebel.) Elocution. (Woodworth.)	Spanish. (Todd.) Old Norse. (Wood.) Theoretical Chemistry. (Morse.) German Conversation. (Goebel.) Elocution. (Woodworth.)	French Conversation. (Fontaine.) Mineralogy: Adv. (Williams.)
10	Physics: Minor. (Kimball.) General Biology. (Martin.) Greek Seminary. (Gildersleeve.) Thermodynamics. (Rowland.) German: Major. (Goebel.) French: Major. (Todd.) Latin Prose. (Morris.) Latin Prose. (Warren.) French Phonology. (Elliott.) Theory of Functions. (Craig.) German Seminary. (Wood.) Elocution. (Woodworth.)	Physics: Minor. (Kimball.) Osteology. (McMurrich.) Practical Exercises. (Gildersleeve.) Thermodynamics. (Rowland.) German: Major. (Goebel.) French: Major. (Todd.) Cicero. (Morris.) Plautus and Terence. (Warren.) Langue d'Oïl Dialects. (Elliott.) Linear Diff. Equations. (Craig.) Mid. High German. (Wood.) Elocution. (Woodworth.)	Physics: Minor. (Kimball.) General Biology. (Martin.) Greek Seminary. (Gildersleeve.) Thermodynamics. (Rowland.) German: Major. (Goebel.) French: Major. (Todd.) Latin at sight. (Morris.) Latin at sight. (Warren.) Italian Dialects. (Elliott.) Ethiopic. (Haupt.) Political Economy: Adv. (Ely.) Theory of Functions. (Craig.) Elocution. (Woodworth.)	Physics: Minor. (Kimball.) Osteology. (McMurrich.) Greek Syntax. (Gildersleeve.) Thermodynamics. (Rowland.) German: Major. (Goebel.) French: Major. (Todd.) Cicero. (Morris.) Plautus and Terence. (Warren.) Romance Seminary. (Elliott.) Political Economy: Adv. (Ely.) Linear Diff. Equations. (Craig.) Elocution. (Woodworth.)	Physics: Minor. (Kimball.) General Biology. (Martin.) Practical Exercises. (Gildersleeve.) Thermodynamics. (Rowland.) German: Major. (Hempl.) French: Major. (Todd.) Cicero. (Morris.) Plautus and Terence. (Warren.) Studies in Administration. (Ely.) Theory of Functions. (Craig.) German Seminary. (Wood.) Elocution. (Woodworth).	Mineralogy: Adv. (Williams.)
11	German: Minor. (Hempl.) Church History. (Adams.) Roman Historians. (Warren.) Greek Prose. (Spieker.) Theory of Equations. (Franklin.) English: Minor. (Bright.) Romance Morphology. (Elliott.) Mammalian Anat. (McMurrich.) Int Course for Grad. (Story.) Elocution. (Woodworth.)	German: Minor. (Hempl.) Church History. (Adams.) Latin Seminary. (Warren.) Xenophon. (Spieker.) Differential Equations. (Craig.) German: Minor: Hist. (Goebel.) English: Minor. (Browne.) Romance Studies. (Elliott.) Animal Physiol. & Histol. (Martin.) Int. Course for Grad. (Story.) Elocution. (Woodworth.)	German: Minor. (Hempl.) English & French Hist. (Jameson.) Xenophon. (Spieker.) Theory of Equations. (Franklin.) English: Minor. (Bright.) Arabic. (Haupt.) Old Fr. Syntax. (Elliott.) Animal Physiol. & Histol. (Martin.) History of Politics. (Adams.) Mineralogy: Adv. (Williams.) Sanskrit: Adv. (Bloomfield. Int. Course for Grad. (Story.) Elocution. (Woodworth.)	German: Minor. (Hempl.) English & French Hist. (Jameson.) Latin at sight. (Warren.) Xenophon. (Spicker.) Differential Equations. (Craig.) English: Minor. (Browne.) Assyrian. (Haupt.) Romance Seminary. (Elliott.) Animal Physiol. & Histol. (Martin.) History of Politics. (Adams.) Mineralogy: Adv. (Williams.) Int. Course for Grad. (Story.) Elocution. (Woodworth.)	German: Minor. (Hempl.) English & French Hist. (Jameson.) Latin Seminary. (Warren.) Xenophon. (Spieker.) Theory of Equations. (Franklin.) German: Minor: Hist. (Goebel.) English: Minor. (Browne.) Mammalian Anat. (McMurrich.) Mineralogy: Adv. (Williams.) Int. Course for Grad. (Story.) Elocution. (Woodworth.)	Atharva-veda and Kauçika-Sûtra. (Bloomfield.) Mineralogy: Adv. (Williams.)
M.	Hist. of Philosophy. (Hall.) French: Minor. (Todd.) Greek Prose. (Morris.) International Law. (Adams.) Gr. & Rom. Hist.: P.H.E. (Jameson.) English: Major. (Bright.) European Hist.: P.H.E. (Holcomb.) Comparative Philol. (Bloomfield.) Physics: Major. (Kimball.) Physiol. of Respiration. (Howell.) Elocution. (Woodworth.)	French: Minor. (Todd.) Demosthenes. (Morris.) Finite Dif. and Interp. (Story.) International Law. (Adams.) Gr. & Rom. Hist.: P.H.E. (Jameson.) English: Major. (Egge.) European Hist.: P.H.E. (Holcomb.) Sanskrit: Elem. (Bloomfield.) Physics: Major: (Kimball.) Introd. to Psychol (Donaldson). Elocution. (Woodworth.)	Psychology. (Hall.) French: Minor. (Todd.) Demosthenes. (Morris.) English Constitution. (Jameson.) English Lit.: P. H. E. (Browne.) Physics: Major. (Kimball.) Lectures. (Wood.) Elocution. (Woodworth.)	Sumero-Akkadian. (Haupt.) French: Minor. (Todd) Demosthenes. (Morris.) Finite Dif. and Interp. (Story.) English Constitution. (Jameson.) English: Major. (Egge.) English Lit.: P. H. E. (Browne.) Physics: Major. (Kimball.) Greek Dialects. (Smyth.) Elocution. (Woodworth.)	Education. (Hall.) French: Minor. (Todd.) Demosthenes. (Morris.) English Constitution. (Jameson.) English: Major. (Browne.) Ante-Class. Hist.: P.H.E. (Adams.) Sanskrit: Elem. (Bloomfield.) Physics: Major. (Kimball.) French Conversation. (Fontaine.) Elocution. (Woodworth.)	
P. M. 1	Hydrodynamics. (Craig.) Calculus. (Franklin.) Anal. Geom.: Adv. (Story.) Polit. Econ.: Minor. (Ely.) Logic. (Morris.) Drawing. (Newell.)	Conic Sections. (Story.) Polit. Econ.: Minor. (Ely.) Logic. (Morris.) Drawing. (Newell.)	Hydrodynamics. (Craig.) Calculus. (Franklin.) Anal. Geom.: Adv. (Story.) Polit. Econ.: Minor. (Ely.) Logic. (Morris.)	Conic Sections. (Story.) Polit. Econ.: Minor. (Ely.) Logic. (Morris.) Drawing. (Newell.)	Hydrodynamics. (Craig.) Calculus. (Franklin.) Anal. Geom.: Adv. (Story.) Polit. Econ.: Minor. (Ely.) Logic. (Morris.) Drawing. (Newell.)	Drawing. (Newell.)
2	German: Minor. (Goebel.) Drawing. (Newell.)	Drawing. (Newell.)		German: Minor. (Goebel.) Drawing. (Newell.)	Drawing. (Newell.)	Drawing. (Newell.)
3	German Style. (Goebel.) (Alternate Mondays.) German: Suppl. (Hempl.) Drawing. (Newell.)	French: Conversation. (Fontaine.) Syriac. (Haupt.) German: Suppl. (Hempl.) Drawing. (Newell.)	Biblical Aramaean. (Haupt.) German: Suppl. (Hempl.)	French Conversation. (Fontaine.) Babylonian. (Haupt.) Comp. Gram. of Greek. (Bloomfield.) German: Suppl. (Hempl.) Drawing. (Newell.)	Sanskrit: Adv. (Bloomfield.) German: Suppl. (Hempl.) Drawing. (Newell.)	Drawing. (Newell.)
4	Trigonometry. (Franklin.) Latin. (Slaughter.) Drawing. (Newell.)	Syriac. (Haupt.) Portuguese. } (Todd.) Old Provençal. } Old Eng. Texts. (Bright.) Drawing. (Newell.)	Trigonometry. (Franklin.) Hebrew Exercises. (Haupt.) Hist. English Gr. (Bright.) Latin. (Slaughter.)	Hebrew: Elem. (Haupt.) Old Eng. Texts. (Bright.) Drawing. (Newell.)	Trigonometry. (Franklin.) Portuguese. } (Todd.) Old Provençal. } Hist. English Gr. (Bright.) Latin. (Slaughter.) Drawing. (Newell.)	Drawing. (Newell.)
5	Hist. of Morphology. (Brooks.) Problems in Mechanics. (Franklin.) German: Elem. (Hempl.)	French: Elem. (Bowen.)	Hist. of Morphology. (Brooks.) German: Elem. (Hempl.	French: Elem. Bowen.)	Hist. of Morphology. (Brooks.) French: Elem. (Bowen.) (Alternate Fridays.) Problems in Mechanics. (Franklin.) German: Elem. (Hempl.) (Alternate Fridays.)	

The public lectures begin at 5 p. m.

OPENING OF THE TENTH ACADEMIC YEAR.

ADDRESS BY THE VENERABLE F. W. FARRAR, D. D., F. R. S., ARCHDEACON OF WESTMINSTER.

The tenth academic year of the Johns Hopkins University was opened by an assembly of the officers and students, and their friends, in the large auditorium of the Academy of Music, at noon, on Thursday, October 1. This departure from the usual meeting in Hopkins Hall was occasioned by the great desire of the citizens of Baltimore to hear the distinguished speaker who had consented to give the opening address.

The Trustees and Faculty assembled in the President's office, at half-past eleven and escorted the speaker,—who was accompanied by the Venerable Archdeacon Vesey, of Huntingdon,—to the Academy. Prayer was there offered by Rev. Dr. Hodges, Rector of St. Paul's Church. A brief introductory address was made by Dr. Gilman, President of the University. Archdeacon Farrar was then presented to the audience and delivered an address of an hour in length, in which he considered The Idea of a Liberal Education in the circumstances of our times. His address was clear, forcible, and admirable in thought, language, and delivery, and was listened to with great delight by the large and cultivated assembly. It was reported in several of the newspapers,—especially in *The Independent*, New York, October 15, 1885, but as it is probable that an authorized copy of the speech will be published by the speaker, at an early day, no full report will here be attempted. The concluding passage, as given in *The Independent*, was as follows:

"I must conclude; but, before I do so, one word on the true aim of education. Whether our education be in the sciences or languages, or perhaps in both, we must set steadily before us that which is the one aim and object we desire to obtain. There are some that wish to know only that they may know, which is base curiosity; and some wish to know only to be known, which is base vanity; and some wish to know only that they may sell their knowledge, which is covetousness. But there are some who wish to know that they may be edified, and some that they may edify; and that is heavenly prudence. In other words, the object of education is neither for amusement, nor fame, nor for profit; but it is that one may learn to see and know God here and to glorify him in Heaven hereafter.

"Our education is desired that, in the language of a Harrow prayer that Archdeacon Vesey and I well remember, 'we may become profitable members of the Church and commonwealth, and hereafter partakers of the immortal glories of the resurrection.' Education is not a couch upon which to rest, nor a costume in which to promenade. Whatever removes us from the power of our senses, whatever brings the past and distant and future into due prominence, is the principle that elevates us in the scale of manhood; and, therefore, that is the true and only object of education. Try to be a man.

"Your late President, General Garfield—a man for whose memory I cannot fail to feel the deepest respect and regard—when only a boy, was asked what he was going to be. He made the answer: 'First of all, I shall try to be a man; and if I do not succeed in that, I am quite sure I will not succeed in anything else.' You all remember, in Scott's 'Rob Roy,' where, in reply to the question, 'Who are you?' Rob Roy replied: 'I am a man.' 'A man, that is very brief.' 'It serves one who has no other answer to give.'

"Our system of education should be to produce men. Behind the clerk, the scholar, the merchant, there should tower the man. There is nothing more fatal than to throw life away in the effort to gain the means of living. Professor Huxley said: 'That man has had a liberal education whose body has been so trained in its youth that it is a servant of the mind, whose mind is stored with great essential truths, whose intellect is like gold, who is full of force and fire, and whose passions have been trained to be the servant of a tender conscience, who has learned to love all beauty, to hate all falseness, and respect others as himself.' I accept that definition of a liberal education as a very fine one; but I would add again, the only true object, as your President has already told us, is an education in righteousness, and in the great essential truths in one or the other of the great forms of religion.

"We live by admiration, hope, and love; there are parts to train that are neither of the mind nor of the body; there are spirits to train. We have bodies, it has been said, but we are spirits; and education is, in its highest and truest function, the education of the spirit; that alone can teach us, after all, the only end of life, which is always that we shall be faithful to the best we know—faithful to God, faithful to our country, faithful to our fellow-men, and faithful to ourselves. Our education will never be perfect, unless, like the Ancient Temples, it is lighted at the top.

"It is only a religious education, after all, which can give us true happiness, and real and permanent success.

"'Take thou no thought for aught save truth and right;
Content, if such thy fate, to die obscure,
Youth fails, and honor; fame may not endure,
And loftier souls soon weary of delight.
Keep innocent! Be all a true man ought!
Let neither pleasures tempt nor pain appall!
Who hath this, he has all in his having naught;
Who hath it not, hath nothing, having all.'"

HOPKINS HALL LECTURES AT 5 P. M.

(The regulations in respect to the admisston of the public to these lectures are given on page 14 of this *Circular*.)

M. RABILLON, Lecturer on French Literature, will give two series of lectures (*in French*) on *Early French Literature*. The literature of the Middle Ages up to the Renaissance will be considered in the first series of lectures:

October 17.—A glimpse of the history of the Middle Ages.
October 24.—Constitution of the Nationality of France; Commencement of a French literature.
October 31.—Introduction to the Chanson de Roland (XI century).
November 7.—Text of the Chanson, with comments.
November 16.—The Troubadours; Bertram de Born; Richard Cœur de Lion (XII century).
November 21.—Villehardouin as a prose writer (XIII century).
November 28.—Roman de la Rose (XIII century).
December 5.—The historian Joinville; St. Louis; The Crusades (XIII and XIV centuries).
December 12.—Froissard's Chronicles (XIV century).
December 19.—Commynes' history of Louis XI (XV century).

FREDERICK WEDMORE, Esq., of London, will lecture on Friday, November 13, *On Modern Life in Art*, and on Saturday, November 14, *On Méryon and the Revival of Etching*.

EDWARD M. HARTWELL, Ph. D., Associate in Physical Training and Director of the Gymnasium, will give six lectures on *Physical Training*, beginning Friday, January 8, and continuing on successive Fridays till February 12.

GEORGE H. WILLIAMS, Ph. D., Associate Professor of Mineralogy, will give three lectures on *The Use of the Microscope in Geology*, on Wednesday, January 13, 20, and 27.

Lectures will also be given on dates to be announced later by:—

REV. W. HAYES WARD, D.D., of New York, Director of the Wolfe Expedition to Assyria;

PROFESSOR ISAAC H. HALL, Ph. D., of the Metropolitan Museum of Art in New York.

PEABODY INSTITUTE LECTURES.

The following courses of lectures are announced by the authorities of the Peabody Institute—to be given on Tuesday and Thursday evenings, at eight o'clock, as follows:

1. MR. WM. BRADFORD, of New York. Six illustrated lectures, Nov. 3–19. *Arctic Explorations and Life in the Arctic Regions.*

2. MR. FREDERICK A. OBER, of Boston. Six illustrated lectures, Nov. 24–Dec. 10. *Mexico, Ancient and Modern.*

3. PROF. F. W. PUTNAM, of Harvard University. Two illustrated lectures, Dec. 15–17. *The "Mound Builders" in Ohio.*

4. MR. RUSSELL STURGIS, of New York. Four illustrated lectures, Jan. 5–14. *Decorative Art.*

5. REV. FRANCIS TIFFANY, of Massachusetts. Two lectures. *Capri and Tiberius; St. Francis of Assisi.*

6. REV. C. W. WENDTE, of Newport, R. I. Four lectures, Jan. 28–Feb. 4. *The Great Composers—Handel, Haydn, Mozart, Beethoven.*

7. PROF. A. M. ELLIOTT, of Johns Hopkins University. Two lectures, Feb. 9–11. *Camoens and the Lusiads.*

8. MR. GEORGE M. TOWLE, of Boston. Four lectures, Feb. 16–25. *The Heroes of Invention.*

JOHNS HOPKINS
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CALENDAR, 1885–86.

1885, Thursday, October 1.	Academic Year Began.
" Thursday, December 24—Saturday, January 2.	Christmas Recess.
1886, Monday, February 22.	Commemoration Day.
" Friday, April 23—Monday, April 26.	Spring Recess.
" Tuesday, June 15.	Term of Instruction Closes.

HOPKINS HALL LECTURES AT 5 P. M.

THE NEW TESTAMENT:—
BIBLIOGRAPHICAL, BIOGRAPHICAL, AND TEXTUAL STUDIES.

PROFESSOR ISAAC H. HALL, Ph. D., of the Metropolitan Museum of Art in New York, will give eighteen lectures on *The New Testament as Transmitted by Printing*, to be followed by two lectures on *The Syrian Antilegomena*, beginning Monday, January 4, 1886, and continuing on successive Tuesdays, Thursdays, and Mondays, till February 16.

These lectures will be addressed not alone to students of the Bible and those who read Greek, but to the general educated public as well; especially to those interested in tracing the transmission of ancient documents from manuscript sources through the vicissitudes of type, and in testing the fidelity with which they are preserved to our times.

The last two lectures of the course deal with subjects partly identical with, and partly akin to, the others; presenting also some phases of transmission when manuscripts are lost or scanty.

As far as practicable, the lectures will be illustrated by specimens or facsimiles. The following synopsis presents an approximate outline of the subjects to be treated:—

I.

Introduction.

(Monday, January 4).

The general subject of printed New Testament texts. Reasons for its general and special interest, both by itself, and connected with other branches of research.

Specimen phenomena of to-day, showing need of wariness in details: Oxford University Press, and its editions of 1885, 1870, and earlier; Pseudo-Beza of 1559 and '60, and its misuse with the English Bible and underlying texts; Pseudo-Leusden of 1675, and that of 1824–80. Gerbelius and Luther's German N. T. Early Greek printing, and its late application to the N. T. Prejudice against the Greek. Booksellers' rivalry and tricks, and complaints thereof by early editors.

Bibliographic hints by N. T. editors, as Mill, Bengel, Wetstein, Greisbach, Scholz, Tregelles, Tischendorf. Bibliographers and bibliographies, special and general. Collectors and collections. Historic New Testaments in America.

II.

The Complutensian Polyglott (1514–1517), and the work of Erasmus (1466–1536).

(Tuesday, January 5).

Stunica and his co-editors. Library of Alcala (Complutum). Means of printing. MSS. employed, and wrong stories about them. Description of Complutensian Polyglott; its cost, issue, distribution, and copies in America.

Erasmus and his work. Froben the publisher. The various editions and their characteristics. Noteworthy readings. History of the insertion of I John v. 7. MSS. and other helps used. Recovery of his (the Reuchlin) MS. of the Apocalypse, by Delitzsch; and Tregelles's re-examination. Apocalypse of Erasmus's 4th ed. Means of classifying texts, and their general characteristics.

(Bibliography and literature. List of test-readings of Complutensian and Erasmian editions, arranged for use with subsequent editors).

III.

Complutensian and Erasmian Descendants (1519, and later).

(Thursday, January 7).

The Aldines, and the first printed Septuagint. Antonio de Nicolinis de Sabio. Gerbelius, and the dubious claim of its parentage of Luther's German Bible. The Basle printers and editors: Wolf. Cephalaeus (Fabr. Capito—Koepffel). Bebelius (Wisendanger). Osiander. Melanchthon's edition. Valder, Plater, Brylinger, &c. Froschauer of Zürich, Curio of Hamburg, Honter of Cracow, Guillard of Paris (Roigny, Bogard, Toussaint), Dupuis and Fezandat.

Complutensian reproduction by Gratz. Compluto-Erasmian of Van Ess. Colinaeus (Simon de Colines) of Paris, his press and work, and MSS. used.

(Bibliography, literature, and test lists of readings).

IV.

Robert Stephen (Estienne) (1503–1559), and his Descendants.

(Monday, January 11).

His life and Work. His MSS. His Paris editions: O Mirifica, Editio Regia. Concordance to Vulgate, and history of verse-division. Geneva edition, the first N. T. divided into verses. Old criticisms thereon. Prevôt

(Haultin, Birkmann). Wechel of Frankfort. Dulci of Venice. Oporinus and Brylinger of Basle. Bill of London. Boecler of Strassburg. London Polyglott. Jo. Crispin of Geneva. Vogel of Leipzig. Selfisch editions. Rihel. Wolder's great polyglott. Scrivener. Influence of this text to-day.
(Bibliography, literature, and lists of test readings).

V.

Erasmo-Stephanic and Compluto-Stephanic Descendants (1552, and later).

(Tuesday, January 12).

General sketch of Erasmo-Stephanic editions, with notice of chief editors and printers; mostly in Germany. Chemnitz-Lyser, at Frankfurt and Geneva. Jo. de Tournes, and Roussin, of Lyons. "Editio Barbirii," the Pseudo Beza of 1559 and '60, and its singular history and products.

Compluto-Stephanic editions. Antwerp Polyglott, and Plantin, with his printing office. Paris Polyglott. Rapheleng. Guy le Fevre de la Boderie. Sam. Crispin. Kirchner (and Arias Montanus). Other editors and printers.
(Bibliography, literature, and lists of test readings).

VI.

Theodore Beza (de Bèze) (1519–1605), and his Descendants.

(Thursday, January 14).

Beza's life and work. Latin N. T. and Annotations. His own editions and their all-important influence on later editors and publishers. Helps and MSS. First use of Syriac version (Tremellius). Mistakes about his works made by later editors. Real author of so-called *textus receptus*. Influence of his work on Continental and English translations.

Henry Stephen (Henri Estienne). His printing, collating, and editing. London edition of Vautrollerius.—Paul Stephen. De Harsy. The great English and Continental families.—Stephano-Beza descendants; Vignon of Geneva, Hafenreffer of Tübingen. Erasmus Schmidt. Gergani and Nicephorus. Wittenberg and Frankfurt printers and editors. Bleau of Amsterdam.—Stephano-Plantin; Elias Hutter and his singular work. Jo. de Tournes.
(Bibliography, literature, and lists of test readings).

VII.

The Elzevirs (1583–1680) and their Followers.

(Monday, January 18).

Their beautiful printing, and great work. Not the originators of the *textus receptus*, but only of its name. Their genuine editions of the N. T., and others of like text. H. Laurens of Amsterdam, Jannon of Sedan, Watts of London (Brit. and For. Bib. Soc.). Moscow edition.—Spread and influence of Elzevir texts on the Continent and in England. Veneration of the text, and mistakes about its character.
(Bibliography, literature, and lists of test readings).

VIII.

The Elzevir Descendants (1633, and later).

(Tuesday, January 19).

The immense English and Continental families, with special notices of individuals. Whittaker (Elzevir). Jansson. Paris "Mazarin" of 1642. H. Laurens, &c. Joh. Leusden, and his work at Utrecht; and the immense number of his descendants. Pseudo-Leusdens. Wetstein. Sketch of subsequent followers in Europe and America. Difficulty of classifying English editions. Printer and Publisher *versus* scholarly editing.

Curcellaeus (Steph. de Courcelles), and his followers. Fell (Oxford) and his followers. Von Mastricht (G. D. T. M. D.), and his followers.
(Bibliography, literature, and lists of test readings).

IX.

The Stephanic-Elzevir and Elzevir-Plantin Descendants (1633, and later).

(Thursday, January 21).

English amateur editors, and publishers: Buck, Daniel, Field, Tonson and Watts, Pickering, &c. Cyril Lucar. Boecler. Cocceius. Pritius. Teubner, &c. Mill, and his epoch-making work. Küster, Bowyer, Baskerville. Birch, of Copenhagen. Clarendon Press. Bagster. Perkins. Hardy, &c. Turin and Padua editions. P. Wilson (and Pseudo-Leusden). Elzevir-Plantin: Cramoisy of Paris. Longmans, etc., of London.
(Bibliography, and lists of test readings; list of test readings as between Stephen and Beza Elzevir).

X.

Critical Attempts before Griesbach (1709–1780).

(Monday, January 25).

Nic. Toinard of Paris. Edward Wells of England, and his opponents. Richard Bentley. Mace. Bengel, and his descendants. Koppe of Göttingen, and his helpers. Stephan. J. J. Wetstein, and his hercalean labors. Bowyer. Harwood. Alter.
(Bibliography, literature, and lists of test readings).

XI.

Griesbach (1745–1812), his Opponents and Descendants.

(Tuesday, January 26).

J. J. Griesbach, his life, work, and editions of the Gr. N. T. David Schulz. Cambridge (American) ed. Kneeland. Bagster. B. Wilson. Tafel. Matthaei. Pharmakides.
(Bibliography, literature, and lists of test readings).

XII.

Griesbach-Elzevir Descendants (1788–1840).

(Thursday, January 28).

Joseph White and his work. "Origenistic" N. T. Aitton of Zwollen. Glasgow and London printers. "Scholastic" Paris editions: Delalain, Didot (Brosset), Darolles, Fix, Lefranc, &c. Gaillard. Valpy. Whittaker. Patrick. Gehringer. Lacheze.

Knapp. Tittmann. Kaeuffer. Hahn. E. Robinson. Vater. Watts, &c.
(Bibliography, literature, and lists of test readings).

XIII.

Minor Critical Editors since Griesbach (1788–1840).

(Monday, February 1).

Paulus, Fritzsche, Bleeck, Rödiger, H. A. W. Meyer, Scholz, English Hexapla, Bagster, Green, Bloomfield.
(Bibliography, and lists of test readings).

XIV.

Lachmann (1793–1851) and his Followers.

(Tuesday, February 2).

Karl Lachmann and his critical work. New path in editing, and its defects. His smaller N. T. Larger N. T., made with Buttmann's assistance. Buttmann, Bornemann, Loch, Rückert, Schott, Rilliet, Friedlieb. (Tregelles's Apocalypse).
(Literature, and lists of test readings).

XV.

Historic editions of the New Testament, down to this point:

(Thursday, February 4).

1. The main line of transmitted text;
2. Remarkable editions; generally in chronological sequence, but modified to compass likenesses;
3. Published Uncial MSS., and collations; and their stimulus and help; with remarks on other critical accumulations, and the general waking up to the need of using ancient sources.

XVI.

Tischendorf (1815–1874); his Life, Work, and Editions.

(Monday, February 8).

Tischendorf's researches, journeys, and results.
Abbot and Gregory. Von Gebhardt.
(Literature, and lists of test readings).

XVII.

Tregelles (1813–1875), and the Editors of Recent Mixed Texts.

(Tuesday, February 9).

Theile. Muralt and his severe critics. Reithmayr. Anger. Wordsworth. Alford. Hahn's later recension. Riggenbach and Stockmeyer. Perowne's editors.

Tregelles; his life, travels, collations. His Apocalypse. His literary works. Accumulations of critical material. His N. T.
(Literature, and lists of test readings).

XVIII.

Westcott and Hort (with a sketch of the past and present circulation of texts).

(Thursday, February 11).

Their "confidential" texts. Character and value of their work. Their theories and text. Their literary labors. Effect of their work on the English Revision and Revisers.

Circulation of the N. T. in different periods, as to kinds and numbers, with kindred data and conclusions of moment. Effect of recent critical labors on modern views of the N. T. text, on important new translations and revisions, and on archæological work in other directions. Obstructionists, and their influence on other branches of research. Present prospects.
(Literature, and lists of test readings).

[The two lectures on *The Syrian Antilegomena* will be supplementary to those above mentioned].

XIX.

The Syriac Apocalypse.

(Monday, February 15).

Absence from Syriac versions of the N. T. Its absence from printed editions of the N. T., with sketch of history of Syriac printing. Extant MSS. *Editio princeps* of De Dieu. De Dieu's literary labors. His "Critica sacra." The Leiden MS. Later editors, and their treatment of the text. Use as a critical aid in determining the original text. Its origin, age, peculiarities, and value. Question of its fidelity. Question of recension. How a text is preserved in a single MS. Hutter's version. The *Pericope de Adultera*, and other Syriac biblical rarities.

XX.

The Antilegomena Epistles (2 Peter, 2 and 3 John, and Jude).

(Tuesday, February 16).

Absence from the Old Syriac N. T. Ancient patristic testimony. Testimony of later Syrian writers. Thomas of Heraclea (Harkel), and the Harklensian version. The common version; its wrong names, and its real origin. Its place in Syriac literature. Its MS. transmission. Extant MSS. Hutter's version. *Editio princeps* of Pococke, and the Bodleian MS. Questions about the Ussher MS. Subsequent editors. Its merits as a text. Question of fidelity. Question of recension. The Williams MS. Use of Syriac study for biblical, historical and archæological research in other languages and directions. (Greek literature; Byzantine history; Phœnician and Assyrian).

(Literature and bibliography).

Cards of admission will be sent to clergymen, theological students, and others specially interested in the subjects treated in the course on application by postal card addressed to the "Johns Hopkins University."

PHYSICAL TRAINING.

DR. E. M. HARTWELL, Associate in Physical Training, and Director of the Gymnasium, will give a course of six lectures on *Physical Training*, beginning on Friday, January 8, 1886, and continuing on successive Fridays, at 5 o'clock, until February 12.

The aim of these lectures will be to show that it is both desirable and practicable to make Physical Training an integral and coördinate part of the elementary and higher education of American youth of both sexes. In order to determine the means conducive to such an end: some of the causes and results of brain-forcing will be noted; the educational value of athletic sports, gymnastics, and military drill will be considered; and the principal experiments, ancient and modern, in combining bodily with mental training will be described and discussed.

The following scheme will suggest approximately the order to be followed in the lectures: —

I.

Introduction.

(Friday, January 8).

Main features of the principal theories concerning Health and Training. Nature and limits of Mental and Physical Training, according to the modern doctrine of the Interdependence of Mind and Body. Characteristics of Athletic, Gymnastic, Military and Technical Training. Peculiarities and educational value of Greek, German, and English Athletic Sports.

II.

American Sports.

(Friday, January 15).

Athletic Sports in America, their inherited and acquired traits. Revival in Athletics since 1860. College Athletics: their rise, extent, and cost; their tendency to become professional; and the need and means of regulating them. Athletics versus Gymnastics.

III.

Foreign Gymnastics.

(Friday, January 22).

Greek Gymnastics, their aims, methods, and influence. Bodily exercise in the education of mediæval scholastics and noblemen. German Gymnastics in school, army, and among the Turners. The Dresden "Turn Fest," of 1885. School Gymnastics in Prussia, and what they teach.

IV.

American Gymnastics.

(Friday, January 29).

Gymnastics in the United States, their German origin, retarded growth, and present condition. Doctrines and methods of Dr. Winship, and Dio Lewis. The Sargent System. College Gymnastics. Gymnastics in Baltimore. American and foreign gymnasiums. The gymnasium of the future.

V.

Military and Medical Gymnastics.

(Friday, February 5).

Military Drill as a means to Physical Training, in comparison with Athletics and Gymnastics. Military Drill in American educational schemes and experiments. The Military and Naval Academies of the United States, and their system of instruction. The training of Prussian cadets. Gymnastics for girls. Medical Gymnastics: what they are, and what they promise to become.

VI.

Reforms in Physical Training.

(Friday, February 12).

Shortcomings of our system of elementary, higher, and professional education as regards instruction in Personal Hygiene. The place and limits of Physical Training in an American reformed system of education. Obstacles to an immediate or general reform in this direction. The needs and possibilities of Baltimore, as regards Athletics and Gymnastics, general and medical.

Seats will be reserved for members of the University who enter their names at the office in pursuance of the regulations. The remainder of the hall will be open to the public without tickets.

BIBLIOGRAPHY FOR LECTURES ON PHYSICAL TRAINING.

The letters H. and P. indicate that the books to whose titles they are appended are accessible in the Johns Hopkins University and Peabody Institute Libraries respectively.

Quick. Educational Reformers. London, 1868. H. P.

Rousseau. Émile. (Translation). Boston, 1885.

Krafft-Ebing. Ueber Gesunde und Kranke Nerven. Tübingen, 1885. H.

Kingsley. Health and Education. (American edition). New York. H. P.

Brigham. Influence of Mental Cultivation upon Health. (Reprinted in London, 1874, from American edition of 1833). H.

Hasse. Die Überbürdung unserer Jugend auf den Höheren Lehranstalten. Braunschweig, 1880. H.

Hertel. Overpressure in Schools. London, 1885.

Grasberger. Erziehung und Unterricht im Klassischen Alterthum. Würzburg, 1864-1881. 3 vols. H. P.

Guhl and Koner. The Life of the Greeks and Romans. London, 1875. P.

Mahaffy. Old Greek Education. London, 1881. P. H.

Waldstein. The Influence of Athletic Games upon Greek Art, in "Essays on the Art of Pheidias." New York, 1885. H.

Mercurialis. De Arte Gymnastica. Amsterdam, 1672. H.

Schaible. The Systematic Training of the Body. London, 1878. H.

Strutt. Sports and Pastimes of the People of England. London, 1833. P.

Furnivall. Education in Early England. London, 1867. P.

Wiese. German Letters on English Education. London, 1877. P.

Starkey. England under Henry VIII. (Early English Text Society's, Extra Series, XII). London, 1871. H. P.

Queene Elizabethes Achademy. (Early English Text Society's, Extra Series, VIII). London, 1869. H. P.

Barnard. English Pedagogy and Schools. Philadelphia, 1862. P.

Mullinger. The University of Cambridge from the Earliest Times to 1535. Cambridge (Eng.), 1873. H. P.

Mullinger. The University of Cambridge from 1535 to the Accession of Charles I. Cambridge (Eng.), 1884. H.

Walker. Manly Exercises. London, 1860. H. P.

Morgan. University Oars. London, 1873. P.

Brendicke. Grundriss zur Geschichte der Leibesübungen. Köthen, 1882. H.

Hirth. Das gesammte Turnwesen. Leipzig, 1865. H.

Gutsmuths. Spiele zur Uebung und Erholung des Körpers und Geistes. Schnepfenthal, 1796. H.

Jahn. Deutsche Turnkunst. Berlin, 1847. P.

Jahn. A Treatise on Gymnasticks. Translated by Beck. Northampton, Mass., 1828. H.

Euler. Friedrich Ludwig Jahn, sein Leben und Wirken. Stuttgart, 1881. H.

Spiess. Turnbuch für Schulen. Basel, 1880. H.

Ravenstein. Volksturnbuch, im Sinne von Jahn, Eiselen und Spiess. Frankfurt a. M., 1876. H.

Puritz. Code-Book of Gymnastic Exercises. Hanover and London, 1883. H.

Rush. Essays: Literary, Moral, and Philosophical. Philadelphia, 1806. H.

Lewis, Dio. The New Gymnastics. Boston, 1869. H.

Wood. Physical Exercises. New York, 1875. P.

Blaikie. How to Get Strong. New York, 1879. H. P.

Watson. Elocution, Calisthenics, and Gymnastics. New York, 1882. P.

Oswald. Physical Education. New York, 1883. H. P.

Hartwell. Physical Training in American Schools and Colleges. Government Printing Office, Washington. (In press).

Hitchcock. Twenty Years Experience in the Department of Physical Education and Hygiene in Amherst College. Amherst, Mass., 1881. H.

Development of Physical Culture in the United States. Barnard's American Journal of Education, Vol. XV.

Barnard. Military Systems and Education. New York, 1872. H. P. (See also Am. Journal of Education, Vol. xxx, 1863). H. P.
Hazen. The School and Army in Germany and France. New York, 1872. H. P.
Kloss. Die Weibliche Turnkunst. 1875. H.
Guhl. Schule und Heer. Berlin, 1882. H.
The Harvard Book. Cambridge, 1875. 2 vols. H. P.
The Princeton Book. Boston, 1879. H. P.
The Yale Book. 2 vols. H.
Yale College: A Sketch of its History. New York, 1879. P.
Schreber. Aerztliche Zimmergymnastik. 19te Auflage. Leipzig, 1884. H.
Unman. Die Schwedische Heilgymnastik. Hamburg, 1881. H.
Heiperz. Die Lungen-Gymnastik. Berlin, 1885.
Heiligenthal. Die Anstalt für Mechanische Heilgymnastik in Baden-Baden. Baden-Baden, 1884. H.
Haasum. Ling's Swedish Gymnastics. London, Paris, and Boston, 1885. H.
Baginsky. Handbuch der Schulhygiene. Stuttgart, 1883. H.
Lincoln. School and Industrial Hygiene. Philadelphia, 1880. H.

INORGANIC GEOLOGY.

Dr. George H. Williams, Associate Professor of Mineralogy, will give three lectures on *The Present Aspect of Inorganic Geology*, on Wednesdays, January 13, 20, 27.

I.
Internal (Hypogene) Forces.
(Wednesday, January 13).

The vital energy of our earth stored as heat in its interior and the manifestations of this energy at its surface. Ideas relating to the condition of the earth's interior; elevation and subsidence of large areas of the crust; mountain-making; earthquakes; volcanic phenomena.

II.
The Microscope in Geology.
(Wednesday, January 20).

The universal, though invisible, chemical changes which are constantly in progress in the rocks of the earth's crust and the use of the microscope in studying them.

III.
External (Epigene) Forces.
(Wednesday, January 27).

The devastating effects of the earth's atmosphere, tending to neutralize the results of internal activity and to reduce the surface to one common level.

Seats will be reserved for members of the University who enter their names at the office in pursuance of the regulations. The remainder of the hall will be open to the public without tickets.

ASSYRIAN ARCHÆOLOGY.

Dr. A. L. Frothingham, Jr., Fellow by Courtesy, will give five lectures on *Babylonian and Assyrian Archæology*, beginning Thursday, February 25, and continuing on successive Mondays and Thursdays till March 11.

I.
Introductory.
(Thursday, February 25).

(Diagram of the country—ancient and modern).

(1) The state of knowledge about the history, language and art of Babylonia and Assyria before this century.

(2) The first discoveries in Persian Cuneiform, at the beginning of the century, by Grotefend, Lassen, Rawlinson and others, and the gradual decipherment of the second and third columns of the famous trilingual inscription of Behistun—the Median and the Assyrian.

(3) Close connection between archæological and linguistic discoveries: excavations of Botta, Layard, Place, George Smith, Oppert, Rassam and De Larzec.

(4) Chief results of these discoveries as regards the reconstruction of the history of the East before the Persian rule. Sketch of the gradual expansion of early Babylonian civilization, of the various states of Northern and Southern Babylonia, and of the rise of Assyria.

II.
Present State of the Science.
(Monday, March 1).

Philology. Theories and discoveries of scholars in England, France and Germany during the last ten years; (Schrader, Delitzsch, Haupt, Hommel, Lenormant, Oppert, Halévy, Guyard, Sayce, Pinchez, etc.).

Ethnography. What were the races of Babylonia? Was the non-Shemitic population Turanian or Cushite? Which race worshipped natural forces, and employed magic? Which race developed an elaborate mythology? How did the religion of the Assyrians differ from this latter?

Literature. The various branches cultivated by the non-Shemites and the Shemites. The earliest hymns and incantations. Religious and historical writings. Preservation by the Assyrians of the ancient literature. Libraries in Babylonian cities and Assyrian palaces. Great importance of literary sources for a knowledge of the history and character of Assyrian art.

Importance of Assyrian for the study of the Old Testament. Historical data found in Assyrian annals relating to the Hebrews.

How far a dependence on Assyrian for the philology and history of the Old Testament ought to be carried.

III.
Archæology and Art:—Babylonia.
(Thursday, March 4).

The great art-centres and their historical relation: Erech, Ur, Sippar, Nippur, Babilu, Borsippa, Kutha, Larsa, Zirpurla, etc. Their great temples, sculpture and decoration. Characteristics of this art: was it in part Shemitic? Ideal and technique. Metal-work especially bronze: enamelling: cylinders. Correspondence of types of Egyptian sculpture of early dynasties with some Babylonian sculpture, especially that of the recent discoveries at Tell-Loh.

IV.
Archæology and Art:—Assyria.
(Monday, March 8).

Distinctive marks of Babylonian and Assyrian art. Secular character of the latter. The great cities of El-Assur, Calah and Nineveh; their palaces and temples. The Assyrian palace: its construction and plan; its sculptural and pictorial decoration. The vault, the arch, the column, the capital. Historical sculptures and enamelled bricks. Religious sculpture: the good and evil demons; the bulls and lions, guardians of the palace. Bronze work. Industrial arts.

V.
Babylonia and Assyria in their foreign relations.
(Thursday, March 11).

Early relations between Egypt and Babylonia; did any exist before the XVIII dynasty? The Mt. Sinai peninsula and the quarry-marks on the Tell-Loh sculptures.

Relations with Elam;—with Syria and the Hittites;—with Phœnicia and Cyprus;—with North Arabia;—with Persia.

The reciprocal influence of Babylonian and Assyrian art and the artistic development of the peoples of these countries.

The influence of Babylon and Assyrian art on Hellenic art through Phœnicia and Asia Minor, and on early Italic art through the Phœnicians.

LECTURES ON PATHOLOGY.

To Physicians and Advanced Students of Biology.

Dr. William H. Welch, Professor of Pathology, will give nine lectures to physicians and students of Biology on *Micro-organisms in Disease*, beginning Wednesday, February 3, and continuing on successive Wednesdays till March 31.

HOPKINS HALL LECTURES.

NOTICE TO MEMBERS OF THE UNIVERSITY.

Seats will be reserved in the front of the hall for such members of the university as give notice of their intention of attending any of these courses of lectures. Such notice must be given in writing before five p. m. of the day preceding the beginning of the course.

The seats will be reserved until five minutes before five o'clock (by the clock in the hall), after which time they will be thrown open to the public. The entrance to the reserved seats will be by the anteroom on the south of the hall.

Schedule of Dates of Public Lectures.

Mondays (January 4–February 15), Dr. I. H. Hall.
" (March 1, 8), Dr. A. L. Frothingham, Jr.
Tuesdays (January 5–February 16), Dr. I. H. Hall.
Wednesdays (January 13–27), Dr. G. H. Williams.
" (February 3–March 31), Professor W. H. Welch.
Thursdays (January 7–February 11), Dr. I. H. Hall.
" (February 25–March 11), Dr. A. L. Frothingham, Jr.
Fridays (January 8–February 12), Dr. E. M. Hartwell.
Saturdays (as hereafter announced), M. Rabillon.

ANNOUNCEMENTS, ETC.

COMMEMORATION DAY.

At a meeting of the Trustees of the University, December 7, 1885, it was

Resolved, that the Tenth Anniversary of the Johns Hopkins University be observed with appropriate ceremonies on the 22d of February next; and that an invitation be extended to all who have taken degrees in this institution to be present on that occasion and receive their diplomas.

RECENT APPOINTMENTS.

DR. CASPAR RENÉ GREGORY, *Privat-docent* in the University of Leipsic, has accepted the position of Associate Professor of New Testament Greek and Palæography in the Johns Hopkins University.

Dr. Gregory is a native of Philadelphia (where his father is Vice-President of Girard College), and he received his academic training in the University of Pennsylvania, and his theological training in part at the Seminary of the Reformed Presbyterian Church at Philadelphia and in part at the Presbyterian Seminary at Princeton. Since 1873 he has been engaged abroad in biblical studies and researches. In 1876, he received the degree of Doctor of Philosophy in Leipsic, and in 1884 he received the distinction, almost if not quite unprecedented among Americans, of being made a *Privat-docent* in that university. After the death of Tischendorf he was selected to complete and publish the prolegomena for the eighth edition of Tischendorf's Greek Testament, of which the first volume has already appeared. He has published a translation in four volumes of Luthardt upon the writings of St. John, and a sketch of Tischendorf's life, in the *Bibliotheca Sacra* for 1876.

Dr. Gregory has recently made a brief visit to this university, —but his instructions will not begin at present, as the investigations upon which he is engaged respecting the manuscripts of the New Testament require prolonged journeys to the libraries and archives of foreign lands. The lectures in his department will be given during the current year by Prof. Isaac H. Hall, Ph. D., of New York.

GEORGE HENRY EMMOTT, Esq., of Manchester (England), has accepted the position of Associate Professor of Logic and Ethics, and Lecturer on Roman Law in the Johns Hopkins University. He received the degrees of Bachelor of Arts and Bachelor of Laws in the University of Cambridge (Eng.) in 1879,—taking first class Honors in Law and History and having previously been a Foundation Scholar of Trinity Hall. He was called to the English bar in 1879 and was made an associate and afterwards a lecturer on Roman law and in Jurisprudence at Owens College (Victoria University), Manchester. He was subsequently made a Reader and Lecturer in English Law to the Birmingham Law Society. He received his Master's degree at Cambridge in 1882. He will assume his position in Baltimore at the beginning of the next academic year.

The Christmas Recess will begin at the close of Wednesday, December 23, and the classes and lectures will be resumed on Monday morning, January 4, 1886.

At a meeting of the Board of Trustees of the Johns Hopkins University held Nov. 2, 1885, the following resolution was adopted:

"*Resolved*, that it is the sense of this Board that students can only be admitted to the Hopkins Scholarships in the University when actual residents of the States from which they are appointed."

In consequence of some misunderstanding, special attention is called to the following regulation passed June 2, 1885, by the Board of University Studies:

Voted, That all students who are following undergraduate courses of instruction will be required to attend such examinations in these courses as may be appointed by the instructors.

Attest, M. WARREN, *Secretary.*

December 5, 1885.

ADDITIONS TO THE REGISTER OF STUDENTS.

(See pp 16, etc., *University Circular* No. 44).

FELLOWS BY COURTESY.

WILLIAM M. ARNOLT. New Brunswick, N. J. (A)
Stuttgart Gymnasium, 1878; B. D., New Brunswick Theological Seminary, 1882. *Greek.*

C. W. EMIL MILLER. Baltimore. 306 *S. Sharp St.*
A. B., Johns Hopkins University, 1882, and Fellow, 1883-85. *Greek.*

FELLOWS (Recent Nominations).

WILLIAM H. BURNHAM. Dunbarton, N. H. 542 *Druid Hill Av.*
A. B., Harvard University, 1882. *Philosophy.*

MARION D. LEARNED. Dover, Del. 247 *Linden Av.*
A. B., Dickinson College, 1880, and A. M., 1883. *Modern Languages.*

GEORGE T. W. PATRICK. Lyons, Iowa. 62 *Bolton St.*
A. B., State University of Iowa, 1878; B. D., Yale College, 1885. *Philosophy.*

UNIVERSITY SCHOLARS (Appointed Dec. 16, 1885).

RICHARD E. BURTON. Hartford, Conn. 86 *W. Monument St.*
A. B., Trinity College, 1883. *English.*

MELVIN E. CROWELL. Geneseo, N. Y. 255½ *W. Biddle St.*
A. B., University of Rochester, 1879. *Philosophy.*

CHARLES G. DUNLAP. Chillicothe, O. 266 *N. Howard St.*
A. B., Ohio Wesleyan University, 1883. *English.*

EDWARD S. ELLIOTT. Savannah, Ga. 262 *W. Hoffman St.*
A. B. and A. M., University of the South, 1884. *Latin.*

MILTON HAIGHT. Pine Orchard, Ont. 52 *McCulloh St.*
A. B., University of Toronto, 1881. *Mathematics.*

C. WILLARD HAYES. Hanover, O. 266 *N. Howard St.*
A. B., Oberlin College, 1883. *Chemistry.*

GEORGE B. HUSSEY. East Orange, N. J. 16 *McCulloh St.*
A. B., Columbia College, 1884. *Greek.*

JOSEPH H. KASTLE. Lexington, Ky. 330 *N. Eutaw St.*
S. B., Kentucky State College, 1884. *Chemistry.*

JOHN E. MATZKE. Ridott, Ill. 134 *N. Eutaw St.*
A. B., Hope College, 1882. *Romance Languages.*

JOHN R. WIGHTMAN. Toronto, Ont. 93 *W. Preston St.*
A. B., University of Toronto, 1871, and A. M., 1872. *Romance Languages.*

GRADUATE STUDENTS.

LUCIUS G. CARPENTER. Agricultural Coll., Mich. 327 *N. Eutaw St.*
B. S., Michigan Agricultural College, 1879, and M. S., 1883. *Mathematics.*

O. EDWARD JANNEY. Baltimore. 242 *N. Eutaw St.*
M. D., University of Maryland, 1881, and Hahnemann Medical College, Philadelphia, 1882. *Chemistry.*

ELIAS J. MCEWAN. Agricultural Coll., Mich. 201 *W. Hoffman St.*
A. B., Kalamazoo College, 1875, and A. M., 1877. *English and Philosophy.*

YUZERO MOTORA. Sanda, Japan. 4 *McCulloh St.*
Doshisha Kioto, Japan, 1884. *Philosophy.*

JENS A. NESS. Red Wing, Minn. 205 *W. Biddle St.*
A. B., Norwegian Luther College, 1884. *Greek and Latin.*

THOMAS K. WORTHINGTON. Baltimore. (A)
A. B., Haverford College, 1883. *History and Politics.*

EDUCATIONAL BOOKS AND PAMPHLETS.

This University has provided a room for educational books and pamphlets, where it is prepared to receive and arrange, for the inspection and use of special students and others most interested, such literature of the classes specified below (which is not always readily purchasable in the market) as publishers and heads of public institutions may desire to commit to the permanent keeping of this institution.

DESIDERATA.

I. Current school reports, whether of town, county, city, or state.

II. Literature pertaining to the care and education of the deaf, blind, feeble minded, and other defectives.

III. Printed matter pertaining to public or private charity and almsgiving.

IV. Reports and histories of reformatory institutions, especially those for the detention of criminal classes of both sexes, old and young.

V. Reports of hospitals, asylums, sanitariums, public or private, where nervous or mental diseases are treated.

VI. All text-books for schools or colleges, from kindergarten to university, together with charts, illustrative apparatus, and school supplies of all kinds, as well as general works on educational topics.

VII. Catalogues, reports, and histories of colleges and professional schools, including law, medicine, theology, and of technological institutions.

VIII. Current numbers and files of educational journals and periodicals.

IX. Articles or addresses by individuals bearing upon the above subjects, and proceedings of societies and associations.

G. STANLEY HALL,

BALTIMORE, MD., *November*, 1885. *Professor of Psychology and Pedagogics.*

All packages should be addressed to

THE JOHNS HOPKINS UNIVERSITY (EDUCATION), *Baltimore, Md.*

SCIENTIFIC NOTES

Including Communications to the University Societies, Correspondence, etc

Correction of Statements relating to Maryland in the Memoirs of F. D. Maurice. With a letter from Col. F. MAURICE to Mr. J. R. BRACKETT.

[Communicated to the Historical and Political Science Association of the Johns Hopkins University, November 13, 1885].

In the very interesting memoirs of the late Frederick Denison Maurice, by his son Colonel Frederick Maurice, there is a passage which refers to the State of Maryland in the following words:

"A short time before the breaking out of the Civil War in America, the State of Maryland, fired by the passionate pro-slavery spirit which the excitement connected with the approaching struggle engendered in some of the Southern States, passed a law, the practical effects of which was to enslave the whole free black population of the State. It happened that at the moment a considerable portion of my father's property was invested in the State funds. He was so horrified at the iniquity of the decree that he immediately had the money sold out, thereby, as it turned out, on very un business-like principles, saving the whole of it from absolute loss." (Vol. ii., chapt. 11.)

These statements are based upon erroneous impressions, and are so injurious to the good name of the State of Maryland as to require correction. The attention of the historical students in this university was called to the matter by Dr. C. J. Stillé, lately Provost of the University of Pennsylvania, in a letter addressed to President Gilman. At the request of Dr. Adams, Mr. J. R. Brackett, a graduate student, who was engaged in the preparation of a thesis upon Slavery as an Institution, looked up the facts and communicated them to the author of the Biography. The substance of the matter was afterwards communicated by Mr. Brackett to the *Nation*, (N. Y., Sept. 3, 1885) in the following words:

"Two notable efforts were made in Maryland for legislation to restrict the liberty of the free blacks. In 1842, a slaveholders' convention, held at Annapolis, recommended new and more severe legislation; but the bill introduced in the Assembly called forth opposition from all parts of the State, and was defeated. In 1860 the Committee on Colored Population in the Assembly advised a new policy toward the free blacks. Of the many suggestions of this Committee, one bill was passed, providing for compulsory servitude of the free blacks of eleven counties, Baltimore City, which had a quarter of the free black population of the State, not being included. But the act was first to be accepted by a majority of voters in these counties at the Presidential election of that year. The result was that in ten counties it was rejected, in most of them by overwhelming majorities, while in the eleventh county, though accepted, it was never enforced. A careful study shows that these attempts at unwonted severity on the free blacks were discouraged by the people of Maryland.

"As to the financial history of Maryland, that State never repudiated its debt. About 1840, there was a large debt, owing to the system of internal improvements, and for a time the interest was not paid; but reform measures were taken, and by 1848 the State credit was well reëstablished. The crisis of the Civil War was also safely passed, the yearly reports of the Comptroller assuring the credit and resources of the State."

Colonel Maurice was in the Soudan, with the forces of Lord Wolseley, when Mr. Brackett's letter reached him. He did not have a copy of the memoir with him, but, nevertheless, with great courtesy and frankness made the following reply which reveals some of the characteristics of his father's life, and at the same time shows how the erroneous statements crept into a memoir which is remarkable for its conscientious accuracy.

LETTER OF COL. F. MAURICE.

"ABOU FATMEH, HANNECT CATARACT ON NILE, SOUDAN, *May 7th*, 1885.

"*My dear Sir:* My address will, I hope, be my apology for the long delay which has attended my answer to your letter of February 20th. I fear your letter cannot have been at once forwarded to me as I have only received it in the last week. You will understand also that here, away as I am from all means of reference even to my own book, my answer to you must be a much lamer one than I should have wished it to have been. I fear that I must have done in this instance (what I very rarely did in writing my book) simply took a story as I had it from my father himself without verifying the details, which only indirectly concerned me as a biographer.

"The circumstances under which my father spoke to me of the incident were these. The money in question had belonged to my mother and, as it was in part to come to me after his death, he was giving a kind of account of his stewardship of it. The facts of which I am sure are these:

"1. That, at the moment when my father decided to sell out, the credit of Maryland not only stood especially high, but that there was every prospect of the value of the property rising in the market.

"2. That the thing which decided him to sell out was some act, either passed by the Maryland Legislature, or receiving so much popular support as to leave a very strong impression that it would pass; which act appeared to my father to be of such a character that as he expressly phrased it to me 'it would have had the effect of practically enslaving the whole of the free black population of the State.'

"Of more than that I am not sure. I know that he spoke to me of what no doubt is the transaction you refer to, viz: that the State had voted a special sum of money, obtained by a special taxation, in order to defray the money due to creditors. He spoke of it as an exceptionally honorable act on the part of the State and I had every intention so to refer to it. You do not quote my words about this part of the matter so that I do not know how far I may have used expressions which implied more than this. I may perhaps have spoken of Maryland as among the repudiating States. No doubt the impression was, from what you tell me, a wrong one but I only used it in order to enhance the credit of the subsequent act of honorable payment and my whole purpose was to convey the impression of the exceptional position of credit in which the Maryland funds stood at the moment when my father decided to sell out. I tried to ascertain the exact date when he did sell out but, when I was at work on the subject, I failed to do this, and, without that datum to go on, I found it almost impossible in England to get at this precise act of the Legislature which had excited my father's wrath. Whether that wrath was justified or not by the act in question I have no means of judging. If I were in London I would try to find somewhere if there be in London any complete file of the Maryland Acts. Of course it is possible that you and my father might have taken different views of the character of the Act.

"I told the story because it was excessively characteristic of my father. The regulation of his monetary affairs in this way, on what seemed to him great principles of right and wrong. His passionate hatred of slavery in all its forms. And again there was something very characteristic of him in the satisfaction with which he recorded the worldly success of his act. Maryland may have weathered the storm during the civil war, but you must be aware that if any one could, from the skies, have given a hint to any speculative or other holder of Maryland bonds that the civil war was coming, the investor would have been very grateful for the hint, and would have promptly sold out. Now my father looked upon any act of, what seemed to him, iniquity, as perpetrated by a State, as a warning from the Highest Heaven, that evil must follow in its train. His whole reading of the old Jewish prophets turned on his belief that they were Statesmen of the most practical character, precisely because they read aright *these* signs of the coming time for good or evil. The interest of this story to me lay in his application of just this sort of vaticination to a practical problem of statesmanship. He may have exaggerated the character of the Act that was passed; or may have supposed that it would certainly become law, when in fact it was vetoed, either by the Governor of the State, or in some other way; but of the character of the transaction on his part and of its *monetary* success I am sure. I am very sorry that in describing it, I should have said anything to wound the feelings of any who hold the honor of Maryland dear, but I am afraid that, in writing it, it had never occurred to me that the matter was now of much importance as regards the State of Maryland; and it was of very great interest as a piece of biography. The real truth is that it was one of several subjects that I should have liked to

thresh out more thoroughly in detail; but I was, for nearly ten years, living in an atmosphere of constant condemnation from all those whose opinion I most valued because of the pains I insisted upon giving to the book and the delay which that necessarily occasioned. I believed myself to be speaking of well-ascertained public facts. I did not see my way to getting at the facts though I had made several efforts to do so and therefore I just told the story as I had every reason to believe correctly, and can only say I am very much obliged to you for thinking the matter of sufficient importance to write to me about it. I fear that under my circumstances out here it will be impossible for me to take any immediate steps in the matter. I will gladly explain it on my return to England in a note to any future edition, and I can only now say that this letter is entirely at your service for any use you may like to make of it. In any case I should be obliged by your showing it to Mr. Brooks and Mr. Gilman, to whom I am also writing.

"Yours very truly,

"F. MAURICE."

To MR. J. R. BRACKETT.

On Krüger's Chronology of the so-called "Summary" of Thucydides. By C. D. MORRIS.

[Abstract of a paper read at a meeting of the University Philological Association, November 6, 1885].

There is not any substantial disagreement among the modern historians, who have treated of the period covered by Thucyd., bk. i, cc. 89–117, as to the dates or the order of the events recorded in those chapters. But K.W. Krüger, in his *Historisch-philologische Studien*, departed very considerably from the chronological arrangement adopted by previous writers. He has not indeed succeeded in securing the adhesion of such authors as Grote, E. Curtius, C. Peter, M. Duncker, &c.; and it would seem therefore at first sight that his innovations might be neglected at this late day. But Classen, in his edition of Thucydides, professes to have been convinced by Krüger's arguments, and has therefore placed the dates at the top of his pages in accordance with Krüger's scheme. As Classen's book has deservedly a wide circulation and great authority, it seemed worth while to examine the grounds on which divergencies so considerable from the current system were maintained. It was the object of this paper to state the results of such an examination. At first the basis on which the accepted chronology rests was set forth; and it was shown that for the dates of the cardinal points in the series of events the evidence was unusually exact and authoritative. The several arguments adduced by Krüger in opposition to this system were then stated one by one; and, when they were thus singly exposed to the light, their extreme tenuity became apparent. It was pointed out also that they are very far from affording each other mutual support; and that occasionally it is promised that one tottering argument shall by and by receive the support it so much needs from another which is to be established hereafter; and that when the turn of the latter comes and an independent basis ought to be provided for it, it is itself left as poorly off as its predecessor, and gains a colorable consistency only on the assumption that the other has already been established on sufficient evidence. After all else has been done, it remains indispensable to alter the text of our authorities; and accordingly, Krüger changes the numerical symbol for 40 into that for 48, on no other ground than that the change is necessary to bring the figures into harmony with the dates he has selected as the true ones. In another place, also, he alters *tenth* into *fourth* solely because the former number, if allowed to stand, will prove that one of his assumptions is incorrect.

Krüger's motive in introducing these arbitrary changes into the chronology appears to have been the laudable one of bringing the story of Pausanias into the necessary contact with that of Themistocles, since Thucydides represents the fate of the latter to have been a result of the fall of Pausanias. It was shown in conclusion that this result can be gained without difficulty and without any tampering with the statements of our authorities, if only we do not, to meet our own views of likelihood, arbitrarily curtail the duration of the several stages in the downward career of Pausanias, or represent the flight of Themistocles to Asia as following instantly on the death of Pausanias; and it was pointed out that there is not a syllable in the narrative of Thucydides which forbids us to give so much extension to the story at the several points indicated as will suffice to leave these events in complete accord with the chronology generally accepted.

The Reduction of ει to ῑ in Homer. By H. W. SMYTH.

[Abstract of a paper read at a meeting of the University Philological Association, November 6, 1885].

Epigraphic testimony proves that the monophthongization of the genuine and spurious diphthong became general in Greece, with the exception of Bœotia and Attica, in the third century B. C.; in Bœotia on the introduction of the Ionic alphabet and in Attica not before the second century B. C., though a few isolated cases date from an earlier period. ει was the original representative of ῑ, but after 50 A. D. it was used sporadically and after 150 A. D. with increasing frequency for ῑ. A sketch of the history of itacism shows, that in the first centuries after Christ (from which period dates our text of Homer) the distinction between ει and ῑ had become a *crux orthographica*, and that at the time of Aristarchus the question was fraught with great difficulty. Up to the present time the hypothesis has prevailed that even in Homer this monophthongization is attested by examples, which have been collected chiefly by G. Meyer. The object of this paper was to submit to a detailed examination all possible instances of this reduction; and the result of a thorough examination of the whole subject justifies the assertion, that with some few limitations, the entire theory of Meyer, Curtius and others, so far as it relates to Homer, rests upon an unstable foundation. Meyer's method does violence to the chronology of the forms under discussion, inasmuch as he assumes that in a given form a Homeric ῑ is younger than an itacistic ει. His citation of epigraphic forms is therefore indefensible. A statistic account of the MSS. of Homer with reference to their tendency to itacism makes the fact evident, that our authority for the genuineness of Homeric forms dates from a period posterior to Aristarchus, who may himself not have preserved pre-Euclidean forms. Osthoff's theory of I. E. vocalization, whereby *e. g.* Greek ῑ's were developed in the proethnic state of the I. E. language from *ei, oi, ai, ie, io, ia* before consonants in a syllable not bearing the chief accent, allows to Greek no individual activity. Instances of ῑ in Homer having ει as a parallel in later literary and epigraphic monuments, are classed by him under the above law. No importance is thus paid to the possibility of itacistic influence.

This hypothesis is the less worthy of acceptation since he assumes that no proethnic root with a long vowel can have arisen from the reduction of a dissyllabic root. Constant reference to good MS. authority and the aid of a new explanation of many forms prove that special Greek laws are sufficient to account for the majority of cases.

A complete list of the material found in the literature of the fifth century and in inscriptions shows that in the *-εί, -ί* adverbs from vowel stems *-εί* was the recognized ending; *a fortiori* is it therefore necessary to read *μεταστοιχεί*, etc., in Homer, the MSS. often having *-εί*. In the case of *-τι* it is probable that the reduction has taken place, a transferring of the short vowel from the consonant-stems not being probable. Hartel's assumption that the dative-locative ῑ of 16 forms (all under the ictus) was derived from ει is incorrect. A discussion of other possible explanations makes it probable that to the influence of the ictus the length of the vowel is to be ascribed. The analogy of Vedic *vaktárī* and a very few similar forms is insufficient to account for ῑ in Greek. In about a dozen cases of *-ῑ́η* (circa 60 in *-ῑ́η*) the reduction from *-ειη* is possible.

An examination of all the substantival and verbal formations claimed as examples of the monophthongization follows. With the exception of ἰδίω (Hesiod εἶδος), which has a proethnic ῑ, and perhaps of κλῖτυς, each case is shown to admit of an explanation destructive to the validity of the theory of Meyer. So *e. g.*

κίων, λίκνον, ἰλαδόν, ἰλύς, ἴκελος, πολίτης, ἀικῶς, ἡμῖν, ἰτέη, νηλιτής, ὁμιλος, σκιά, αἴρω, τίω τίνω, φθίω φθίνω, χρίω, ἵκω, κινέω κίνυμαι, πίομαι.

χίλια should be *χείλια* in Ionic from the analogy of parallel dialectical forms. The variable orthography on old inscriptions may account for the seeming ancient itacism. The ῑ of *μίσγω* is obscure, if the grammarians are correct in their assumption of vowel-length.

Motor Sensations of the Skin. By G. Stanley Hall and H. H. Donaldson.

[Abstracted from *Mind*, London, No. XL].

Our first problem in undertaking the following lines of research, which have now been carried on almost continuously for eighteen months, and which so far as we know are mainly new, was to devise a suitable apparatus.

This consisted of wheelwork running an endless band. To the band was fastened a car which carried the writing point. This point could be made to travel in a given direction with known rate, pressure, etc., the movement being perfectly uniform. Under conditions thus known it was allowed to travel over the skin on various parts of the body, and the resulting sensation noted. Variations could be made in the direction in which the point travelled, in the rate, the size of the point, the weight with which it pressed on the skin, and in the part of the body used. All the general rules guiding such investigations were observed.

I. *Error in Judgment of Direction of Motion on the Skin.* In making these observations the part of the body on which the experiments were to be made—namely, the back, more commonly the leg, or much the most frequently the fore-arm—was placed on the support in a fixed position under the car, the eyes of the percipient being closed. The operator set the apparatus in motion and also a metronome, and, after the *advertisement* "ready," dropped the weight gently and noiselessly into the cup, which thereby pressed the button upon the arm. As soon as the percipient had determined whether the motion was up or down the limb, or (more generically) to or from the head, he said *plus* for up and *minus* for down. The time and judgment were recorded by the operator, and subsequent trials in the same way and over the same dermal tract, sometimes to the number of twenty or thirty in a sitting, were made till signs of fatigue began to appear. The following table gives the gross results of many observations.

TABLE I.

Persons.	No. of Observations.	No. of Errors.	Errors. in per ct.	+ J −	− J +	Ratio of last two columns.
H. H. D.....	2057	434	21	73	361	1 : 4·6
W. N.....	1000	166	16	78	88	1 : 1·1
J. V. D.....	774	6	0·7	0	6	
G. S. H.....	515	68	13	29	34	1 : 1·4
C. D.....	264	11	4	0	11	
H. T.....	144	6	6	2	4	1 : 2
Total—	4754	691	14+	182	504	1 : 2·7+

The headings of the fifth and sixth columns mean respectively number of times when motion up the limb was judged to be motion down it, and *vice versâ*. In this table no account of rates of motion, of weights or of the surfaces of skin tested is taken. For each of these conditions, so far as they were explored in our research, as well as for all in the aggregate, the following law appears. We are more likely, when in doubt, to judge motion on the surface of the limbs to be up rather than down their axis.

The question next taken up was:

II. *Time-relations of Judgments of Motion on the Skin.* The following table is based on the same observations as table I., the only difference being that a number of series available for direction and not for time are excluded, and a few new ones added.

TABLE II.

Persons tested.	Number of single observations.	Average time* of all judgments.	Average time of judging + movements.	Average time of judging − movements.	Average time of correct judgments.	Average time of wrong judgments.	Average time of judging − to be + movement.	Average time of judging + to be − movement.
H. H. D.....	1956	7·8	6·1	9·4	7·0	10·3	11·0	6·6
W. N.....	935	4·09	4·4	3·9	3·3	7·5	7·4	7·9
J. V. D.....	744	2·6	2·4	2·7	2·5	5	5	0
G. S. H.....	416	3·8	3·9	3·7	3·4	6·8	7·5	5·8
C. D.....	263	1·80	1·54	2·1	1·72	4	4	0
H. T.....	144	4·42	4·36	4·44	4·37	5·5	6	4·5

* All the above times are in seconds.

From this table it appears (1) that a judgment of motion down the limb takes more time than that of an upward movement; (2) that the time for a wrong judgment is much greater than—sometimes more than twice as great as—the time needed for a correct judgment; (3) that of the two errors it takes longer to judge *minus* to be *plus* movement than the reverse.

III. *Effect of varying the Rate of Movement or the Distance which must be traversed before the Judgment is made.* We now began to fix our variables. The following table is accordingly made on one person H. H. D., with a constant weight of 15 grammes, with a circular metallic point 2 millimetres in diameter, and on a definite part of the volar surface of the right arm so arranged that the point traverses the same tract in moving up or down and in successive sittings.

TABLE III.

Rate per second in centimetres.	Total number of judgments.	Distance in cms. before a judgment was made.	Number of correct + judgments.	Distance before a judgment was made.	Number of correct − judgment.	Distance before a judgment was made.
·012	37	·5172	20	·381	4	·733
·034	55	·7888	18	·690	7	·707
·035	65	·5635	19	·427	13	·731
·044	34	·8492	12	·871	10	·836
·046	88	·6624	29	·587	27	·903
·050	11	·6050	4	·675	3	·650
·078	95	·7254	24	·577	30	·657
·086	87	·5782	33	·559	29	·498
·178	40	·5696	14	·569	13	·480
·200	27		8	·640	2	·300
·200	50		19	·680	11	·920
·200	50		23	·560	10	·580
·200	46		22	·660	8	1·060
·200	18	·7600	5	·880	5	1·080
·200	26		13	·820	11	1·340
·200	26		12	·500	6	·800
·200	26		11	·400	11	·500
·850	43	·4760	14	·425	14	·586
1·500	30	·5100	10	·570	6	·885

The most obvious result from this table is that while the discriminative sensibility for compass-points on this part of the arm, measured longitudinally, could rarely be brought below 25 mms., even in single observations, motion is recognized and its direction discriminated at an average distance of between 6 and 7 mms. The next result is that, while the rate of motion increases more than one-hundred-and-twenty-fold and the time of judgment varies in proportion, the distance traversed at these great differences of rate remains relatively uniform. We may therefore assert the existence of smaller motor "sensory circles" (under the conditions of this table) inside Weber's discriminative circles, with a longitudinal diameter about only ¼th as great, and with a transverse diameter yet to be reported on.

IV. Reproductions of the rate at which the point was moving over the skin and also of the distance which it moved were made with the other hand on a suitable apparatus. The results were: (1) that *plus* movements seem, as judged from the record, larger than equal *minus* movements; (2) that short distances are relatively longer in reproduction than long distances.

V. The motor sensibility of different parts of the body was tested with the general result of finding it dull or acute where such a state was to be expected.

The temperature sense was excluded in later experiments by the use of cork points, as it was found that with metal points it materially aided in the judgment of direction. The hairs on the skin were also attended to with great care, but so far as observations went they were apparently of little importance in influencing the judgments in this investigation.

Incidentally, the great complexity and diversity of dermal sensations has been often and in many ways apparent. If a point be allowed to move over ten or twelve inches of dermal surface and if the weight is light, it is found that at certain spots the impression of contact is lost, and again the rate seems to change as if there were acceleration-points. If instead of weights we substitute a metallic point of a square millimetre in area, joined to the secondary coil of a sledge inductorium, holding the other electrode in the form of a wet sponge in the hand, the experiences of its journey down the arm are manifold and vivid. For a time tickling is quite unpleasantly dominant, at other places the point seems to scratch, at others the thrilling quivering sensation familiar in electric stimulation seems dominant, while at others sharp sudden cutting pains and at still others no sensation save that of a moving point are felt. The nature of these sensations varies

greatly with the strength of the stimulus, and very soon the arm in the vicinity of such application is so fatigued as to be quite worthless for experimentation for a long time. It is moreover extremely hard to sharply differentiate and identify sensations that seem to be so impacted and run together, and which language has never before been called upon to disentangle.

In conclusion, it would seem that "local signs" are quite heterogeneous, and that, in the strong tendency we have to move the touching dermal surface over objects in contact with it, we are seeking not merely to multiply but to diversify our sensuous data for judging the nature of the impressions and to fill up the dermal "blind spots" between which impressions are sifted in to us. The astonishing development which dermatology seems now undergoing is no less striking from the psychological than from a pathological or anatomical standpoint. The effect of disturbed dermal functions in affecting psycho-sensory sanity; the fact of the genetic origin of senses and central nervous system from the external embryological layer; the function of specialised dermal sensations in presiding over the exercise of the sexual activities; and the relation of what the old psychology roughly called Touch in giving us the primary qualities of matter—all indicate the skin as not only the primeval and most reliable source of our knowledge of the external world, or the archæological field of psychology, but as a just opening experimental domain of great breadth, where work seems now possible that may compare in both quality and quantity with that accomplished in physiological optics, and which may shed new light on some of the most fundamental problems of psychical action and unfolding.

On the Temperature Sense. By HENRY HERBERT DONALDSON.

[Abstracted from *Mind*, London, No. XXXIX, with additions by the author].

An account of this investigation has already been given in a preliminary notice in the *Circular*, No. 39, May, 1885.

The substance of the account was as follows. It was found that the sensations of heat and cold were excited at definite spots on the surface of the body. That a spot to which the adequate stimulus was applied reacted by causing the sensation of either heat or cold alone, and that it was not possible to get both sensations from the same spot. These spots were mapped for several portions of the body, and their general distribution, extent, and the relative intensity of their reaction, &c., determined. They were tested by electrical stimulation, by applying hot and cold points to the skin and also by radiant heat from a platinum point. A cursory histological examination of bits of skin failed to show any characteristic nervous mechanism at these sensitive spots. The bearing of the results was indicated as twofold, namely, as bringing one group of skin sensations under the law of the specific energy of nerves and as indicating a factor which must be more carefully taken into account in experimenting on the skin.

The article in *Mind* was not published until after an important paper by Goldscheider (*Monatshefte f. prakt. Dermatol.*, Bd. III, Nos. 7, 9, 10, 1884; Bd. IV, No. 1, 1885) had been received. This led me to repeat some of the experiments of that author. Besides the results already recorded by others, he calls attention to the often observed fact that the tactile and thermal sensibilities in different parts of the body do not vary uniformly, and he points out that the discriminative sensibility when measured on two thermal spots is, as a rule, much finer than when measured in the ordinary way, and that this discrimination is finer the more intense the stimulus. In certain parts, as, for instance, those in which it is finest, discrimination for tactile-sensations surpasses that for temperature-sensations.

These sensations of temperature can be roused by mechanical and electrical stimulation as well as thermal. In both cases the cold-spots are more easily discriminated than the heat-spots.

By sending a strong electrical current through the arm and parts of the hand and thus stimulating certain nerve-trunks, Goldscheider is able to get peripheral sensations of temperature; here, too, the sensations of cold tend to predominate. He finds these spots insensitive to pain or contact. A needle may be plunged into them, or excessive temperatures applied without causing any feelings of discomfort.

Finally he reaches the conclusion that the temperature nerves often radiate from centres and these centres often coincide with the hair follicles. Regarding the reactions of the temperature spots I was able to confirm the observations made by Goldscheider as above given, except that I could not feel certain that pressure sensations were entirely wanting at the temperature spots.

One independent contribution was also made to the subject.

Dr. M. Warfield called my attention to the fact that in a certain operation on the eye by Dr. Russell Murdoch, cocaine having been used, the patient recognized the presence of the knife on the eye by a sensation of cold. By the courtesy of Dr. Murdoch, I was enabled to examine the eyes of several patients. When the eye in these cases was completely insensible to pain, and felt no contact whatever, cold and warm bodies were readily distinguished. This observation I have been able to repeat on my own eye. By means of 5 per ct. solution of muriate of cocaine the eye was rendered completely insensitive to pain or contact, but still readily felt heat and cold.

Dr. J. N. Mackenzie examined the throats of several patients after applying cocaine and found results analogous to those obtained in the eye.

In these cases we have the temperature-sensations completely isolated from the other dermal sensations in a way which is now capable of easy repetition, and important as furnishing another argument for the independence of the thermal apparatus.

In this connection it may be mentioned that, contrary to the explicit statement of Weber, I find the œsophagus, through its entire length, sensitive to temperature, both in myself and in a number of others. Some individuals do not distinguish clearly the temperature of a body in the œsophagus, but I have not found them as numerous as those that do. The tests were made with cold and hot water, at a temperature of 4° C. and about 50° C.

From all this, it follows that the end-organs for the sensation of heat and cold will have to be made out not only in the skin proper but also in the conjunctiva and lining membrane of the œsophagus as well.

On the R. G. F. for the Quintic.

[Extract from a letter by MR. J. HAMMOND to Dr. Craig].

BUCKHURST HILL, ESSEX, October 3, 1885.

I send you herewith the MS. of a paper "On the Cubi-quadric System," which is intended to illustrate a remark, in my paper on Perpetuants, &c., to the effect that my methods would apply with equal facility either to a single binary quantic or to systems of binary quantics.

While working at the Cubi-quadric, the thought flashed upon me—"What if the negative terms of the R. G. F. for the Quintic could be built up with c and u only." On a trial, which occupied perhaps five minutes, I found that the following form of R. G. F. could be obtained:

$$\begin{aligned}&(1+d+h+j+m+hj)(1-cu)\\&+(e+k+o+dj+s+j^2+jk+t+jm+jo+v+js+jt+w)(1-c)\\&+(f+i+l+n+p+r)(1-u)\end{aligned}$$

$$(1-a)(1-b)(1-c)(1-g)(1-g)(1-u)$$

R. G. F. for the Sextic.

$$\begin{aligned}&1-CDW\\&+E(1-CDW)\\&+F(1-DW)\\&+G(1-W)\\&+H(1-C)\\&+J(1-DW)\\&+K(1-CW)\\&+L(1-W)\\&+M(1-DW)\\&+N(1-D)\\&+O(1-W)\\&+E^2(1-CDW)\\&+Q(1-D)\\&+R(1-W)\\&+S(1-D)\\&+T(1-W)\\&+EK(1-C)\\&+U(1-CD)\\&+EM(1-D)\\&+EN(1-D)\\&+V(1-D)\\&+E^2(1-C)\\&+X(1-D)\\&+ES(1-D)\\&+EU(1-D)\\&+E^2M(1-D)\\&+Y(1-D)\\&+EX(1-D)\\&+Z(1-D)\end{aligned}$$

This differs from the R. G. F. in Prof. Cayley's tenth memoir on Quantics, only in the 26 negative terms of the numerator which have much simpler expressions than his. It is also to be observed that those negative terms of the numerator, 12 in number (viz. *dcu*, *hcu*, *jcu*, *mcu*, *hjcu*, *djc*, j^2c, *jkc*, *jmc*, *joc*, *jsc*, and *jtc*), which *are not binary combinations of the letters*, exactly correspond to the 12 reducible syzygies included in Prof. Cayley's list, but excluded from my Syzygy Tables. As I did not know this form of R. G. F. when I gave names to the 167 irreducible syzygies, some few of the names in my tables will be inappropriate to it.

I also found, but with much more trouble, the R. G. F. for the Sextic, given on the other side. Obtaining that for the Quintic must be considered either as an inspiration or a peculiarly happy guess, I have tried others but have been unable to obtain in any other case anything as simple, except the R. G. F. of the Cubi-quadric. The form (IV) of numerator of the R. G. F. of the Cubi-quadric in my paper seems to indicate the proper form of R. G. F. for single binary quantics higher than the Sextic. . . .

J. HAMMOND.

P. S.—I now intend to resume work on the Quintic.

$$(1-A)(1-B)(1-C)(1-D)(1-I)(1-P)(1-W)$$

On forms reducible to the forms (a, o, c), $(a, \frac{1}{2}a, c)$, and (a, b, a). By J. C. Fields.

[Abstract of a paper read before the University Mathematical Society, Wednesday, October 21st].

I. Suppose (a, b, c) to be a form reducible to the first of above forms, and $\begin{vmatrix} \lambda & \mu \\ \nu & \rho \end{vmatrix}$ the determinant of substitution which reduces it to such form.

The conditions to which (a, b, c) is subject are then:

1. $a\lambda\mu + b(\lambda\rho + \mu\nu) + c\nu\rho = 0,$
2. $\lambda\rho - \mu\nu = 1, \quad \therefore \quad \lambda, \rho$ prime to $\mu, \nu.$

We may write (1) in forms

$$\mu(a\lambda + b\nu) + \rho(b\lambda + c\nu) = 0,$$
$$\lambda(a\mu + b\rho) + \nu(b\mu + c\rho) = 0,$$

from which:—

3. $a\lambda + b\nu = a\rho, \qquad b\lambda + c\nu = -a\mu,$
$a\mu + b\rho = \gamma\nu, \qquad b\mu + c\rho = -\gamma\lambda.$

where a, γ are integers.

Solving from any three of these last four equations for $\lambda : \mu : \nu : \rho$, we get,

$$\frac{\lambda}{a(\Delta + a\gamma)} = \frac{\mu}{b(\Delta + a\gamma)} = \frac{\nu}{0} = \frac{-\rho}{a(\Delta + a\gamma)},$$

where $\Delta = ac - b^2 \therefore \Delta + a\gamma = 0.$

And with this last condition we may show that only two of conditions (3) are independent, say:—

$$a\lambda + b\nu = a\rho, \qquad b\lambda + c\nu = -a\mu.$$

Our complete conditions are:

$$a\lambda + b\nu = a\rho, \qquad b\lambda + c\nu = -a\mu,$$
$$\lambda\rho - \mu\nu = 1, \qquad \Delta + a\gamma = 0.$$

Eliminating μ and ρ from these equations we get,

$$(a\lambda + b\nu)^2 + \Delta\nu^2 = a\alpha, \qquad \Delta + a\gamma = 0,$$
$$a\lambda + b\nu \odot a, \qquad b\lambda + c\nu \odot a.$$

The last of these conditions can be shown to follow from the first and third; omitting, therefore, this last condition, substituting $a\rho$ for $a\lambda + b\nu$ in first of conditions and dividing through by a, our final conditions are:

I. $a\rho^2 - \gamma\nu^2 = a, \qquad$ II. $a\lambda + b\nu \odot a, \qquad$ III. $\Delta + a\gamma = 0.$

Being, therefore, given any form (a, b, c), to find whether it is reducible to form (a, o, c), we divide Δ into its different pairs of factors $(a, -\gamma)$, solve I integrally for (ν, ρ) and find whether value of λ derived therefrom satisfies II. If we can find such values for ν, ρ, then (a, b, c) can be reduced to a form (a', o, c').

II. The conditions that (a, b, c) be reducible to a form (a', b', a') are:

$$a\lambda^2 + 2b\lambda\nu + c\nu^2 = a\mu^2 + 2b\mu\rho + c\rho^2, \qquad \lambda\rho - \mu\nu = 1.$$

In these conditions, putting

$$\lambda - \mu = \lambda', \qquad \lambda + \mu = \mu', \qquad \nu - \rho = \nu', \qquad \nu + \rho = \rho',$$

our conditions become

$$a\lambda'\mu' + b(\lambda'\rho' + \mu'\nu') + c\nu'\rho' = 0, \qquad \lambda'\rho' - \mu'\nu' = 2,$$

which are similar to those in case I, and can be reduced by the same process to the conditions $a\rho'^2 - \gamma\nu'^2 = 2a, a\lambda' + b\nu' \odot a$, with the additional precaution $\lambda' - \mu' \odot 2, \nu' - \rho' \odot 2.$

III. The conditions that (a, b, c) be reducible to a form $(a', \frac{1}{2}a', c)$ are:

$$a\lambda^2 + 2b\lambda\nu + c\nu^2 = 2a\lambda\mu + 2b(\lambda\rho + \mu\nu) + 2c\nu\rho, \qquad \lambda\rho - \mu\nu = 1,$$

which, on making the substitutions,

$$\lambda = -\lambda', \qquad \lambda - 2\mu = \mu', \qquad \nu = -\nu', \qquad \nu - 2\rho = \rho',$$

reduce to:

$$a\lambda'\mu' + b(\lambda'\rho' + \mu'\nu') + c\nu'\rho' = 0, \qquad \lambda'\rho' - \mu'\nu' = 2,$$

which are the same conditions as in case II, and give precisely the same final conditions.

PROCEEDINGS OF SOCIETIES.

Scientific Association.

November 4.—Sixty-sixth regular meeting. Professor Martin in the chair. Fifty-eight members present.

The following officers were elected: President, Professor Remsen; Vice-President, Professor Rowland; Secretary, Dr. Howell.

Papers read:

Motor Sensations of the Skin, by H. H. Donaldson. (*See p.* 36).

Concerning the Space Relations of Atoms in Molecules, by L. Remsen.

Recent Composite Portraiture, by J. Jastrow.

The applications of Composite Photography fall under two heads. (1) Given a series of representations of the same object to find a single representation which shall combine the advantages and neglect the individual disadvantages of each of the scenes. (2) To elicit a type: *i. e.* a pictorial average. A good example of (1) is the recently issued volume of Mr. Walter Rogers Furness, in which he combines the most reliable portraits of Shakespeare and presents us with a newer and probably a truer portrait than any of the originals. Mr. Taylor, a Philadelphia photographer, has applied the same method for obtaining an authentic Washington (*Journal of the Franklin Institute*, October, 1885). He has also obtained a composite portrait of the officers of the American Association (*Science*, August 28, 1885) which comes under the second head. There was exhibited a composite of ten criminals; a composite of ten New England Female College graduates, and Mr. Galton's recent Jewish types (Anthropological Institute (London), August, 1885, and *Science*, October 9). Attention was also directed to Mr. Galton's composites in the *Journal of the Institute of Great Britain*, 1879, and in Guys Hospital Reports, 1879. The apparatus for combining photographs optically described in *Science*, August 28, was shown.

Preservation of Marine Animals, by W. K. Brooks.

December 2.—Sixty-seventh regular meeting. Professor Remsen in the chair. Forty-eight members present.

Papers read:

Demonstration of some Recent Psycho-physical Apparatus, by G. S. Hall.

A new Method of Demonstrating Geometrical Theorems, by W. E. Story.

On the Liquefaction of Gases, by H. Crew.

Philological Association.

November 6.—Sixty-fourth meeting. Professor Gildersleeve in the chair. Forty-two members present.

Papers read:

On Krüger's Chronology of the Pentecontaëtia of Thucydides, by C. D. Morris. (*Abstract on p.* 35).

On the Reduction of ει to ι in Homer, by H. W. Smyth. (*Abstract on p.* 35).

December 4.—Sixty-fifth meeting. Professor Gildersleeve in the chair. Fifty-one members present.

Papers read:

French Speech-mixture in Canada, External Influences, by A. M. Elliott.

Notes on Isaeus, by E. H. Spieker.

On Silent *l* in Modern English, by J. W. Bright.

Historical and Political Science Association.

October Meetings.—Dr. H. B. Adams in the chair.

Papers read:

The Study of History at Harvard College, 1636-1849, by H. B. Adams.

Socialism and the Labor Question, by E. W. Bemis.

November Meetings.—Dr. H. B. Adams in the chair.

The Civil Service of Baltimore, by D. R. Dewey.

Correction of Statements relating to Maryland in the Memoirs of F. D. Maurice, by J. R. Brackett. (*See p.* 34).

The Founder of McDonogh Institute, by William Allan.

History of the MS. Records of the Virginia Company, by J. F. Jameson.

Mathematical Society.

October 21.—Professor Newcomb in the chair. Ten members present.

Papers read:

On the Sum of the Squares of the Binomial Coefficients, by F. Franklin.

On Forms Reducible to (a, o, c), $(a, \frac{1}{2}a, c)$, and (a, b, a), by J. C. Fields. (*Abstract on p.* 38).

November 18.—Professor Newcomb in the chair. Seven members present.

Paper read:

On the Parametric Representation of any Point on a Conic through Five given Points, by W. E. Story.

Baltimore Naturalists' Field Club.

October 15.—Twenty-three members present. The following officers were elected:

Dr. G. H. Williams, President; F. H. Herrick, Secretary; G. L. Smith, Chairman of the Botanical Section; Dr. J. P. McMurrich, Chairman of Zoological Section; W. S. Bayley, Chairman of the Geological Section.

A resolution was adopted to petition the Board of Park Commissioners for permission to label the trees in Druid Hill and Patterson Parks with both scientific and common names.

Mr. Basil Sollers mentioned a rare form of Oxalis Violacea which he found in bloom August 25, and again in great abundance September 20, near Ellicott Mills. Mr. Sollers stated that he had spent considerable time during the summer in identifying the plants in the vicinity of Baltimore, near Monrovia, Frederick Co., on Kent Island, and at Glyndon. He had identified 440 species and prepared specimens of many of these for the herbarium of the Field Club.

November 25.

It was decided to continue the monthly meetings of the Club during the winter, when popular talks on subjects of general scientific interest will be given by different members.

Dr. McMurrich made some remarks upon the advisability of a thorough study of the Invertebrate fauna of the vicinity of Baltimore, and reported the results of some surface collecting on the Patapsco near Curtis' Creek. The forms obtained were a Ctenophore (Mnemiopsis), a Discomedusa, probably Aurelia aurita, large quantities of the Cladocerau Evadne, and a Calanid Copepod which exhibited very markedly coloration produced by sexual selection.

Mr. F. H. Herrick gave the results of some observations made (November 14-21) on the Vitality of Plants as exhibited by their persistence in producing flowers. Within the time mentioned 40 species of plants were found in flower. Of these, 18 belong to the order Compositae, and 20 or one-half are weeds introduced from Europe. The latter are the freshest at this period of the year and produce flowers and fruit in greatest abundance. Of the non-introduced plants, single specimens were commonly found, and these small or withering. Leaving the latter out of consideration, the late flowering of the introduced plants is readily explained. Many of them are perennial in the milder climate of Europe, and consequently when brought to this country strive to produce flowers and fruit the year round. Stellaria media, the common Chickweed, is a type of this class, and is virtually in flower the whole year. The buds and flowers expand as soon as the ice melts from around them in spring. This plant was dug from beneath two feet of snow in midwinter in Vermont, and after being placed in water a few hours, its flowers were fully expanded. This explains its phenomenally early appearance in spring. The Dispersion of Seeds was illustrated by the pods of Cassia nictitans and the "button balls" of Platanus occidentalis. The latter tree produces on the average 1000 seeds to each ball, and therefore in some cases many millions of seeds, yet it is far from common in this and other localities. The oak which produces relatively so much less seed is the prevailing tree in this region. The Sycamore belongs to an ancient type, being found among the fossils of the Laramie group. The conditions for its abundant growth are apparently less favorable than formerly.

Dr. B. W. Barton spoke of the bursting of the pods of the Wistaria, comparing the sound produced to a pistol report.

PHOTOGRAPH OF THE NORMAL SOLAR SPECTRUM

MADE BY

PROFESSOR H. A. ROWLAND.

This photographic map of the Solar Spectrum is now complete from wave length 3680. to 5790. and the portion above 3680. to the extremity of the ultra violet, wave length about 3100., is nearly ready. Negatives have also been prepared down to and including *B* and it is possible they may be prepared for publication.

These photographs have been made with one of Professor Rowland's concave gratings of 21½ ft. radius of curvature and 6 in. diameter, mounted so as to preserve the focus constant and give a normal spectrum of the same scale for any given spectrum. A scale of wave lengths has been added so that the whole makes a map of the spectrum, down to wave length 5790., more exact and giving greater detail than any other map now in existence. The error in the wave length at no part exceeds $\frac{1}{50000}$ of the whole, and is generally caused by a slight displacement of the scale which is easily corrected. The wave lengths of more than 200 lines in the spectrum have been accurately determined to about $\frac{1}{500000}$ part and these can serve as standards to correct any small error of the scale. It is to be noted that the photograph of the spectrum can have none of the local irregularities of wave length which occur in all engraved maps and which amount to more than $\frac{1}{20000}$ part in all so far published. This often so distorts a group of lines as, in conjunction with the imperfect intensities, to render them almost unrecognizable.

The definition of the spectrum is more than equal in every part, down at least to wave length 5325., to any map so far published. The 1474 line is widely double as also b_3 and b_4 while *E* is given so nearly double as to be recognized as such by all persons familiar with spectrum observation. Above the green the superiority increases very quickly so that at *H* we have 120 lines between *H* and *K* while the original negatives show 150 lines. The photographs show more at this point than the excellent map of Lockyer of this region. Above *H* to wave length 3200. the number of lines in excess of all published maps is so great as to make all comparison useless. However, above *H* the determination of the wave length is more uncertain than in the visible parts and must remain so until a special investigation can be made.

The plates all contain two strips of the spectrum except No. 2 which contains three. They are three feet long and one foot wide.

Plate No. 1.	Wave length	3710.	to	4135.	Scale 4	times	Angström.
2.	" "	3100.	to	3730.	" 3	"	"
3.	" "	3680.	to	4135.	" 3	"	"
4.	" "	4075.	to	4530.	" 3	"	"
5.	" "	4480.	to	4935.	" 3	"	"
6.	" "	4875.	to	5325.	" 3	"	"
7.	" "	5210.	to	5790.	" 2	"	"

These can now all be furnished to order except No. 2, the negative of which is being made.

The prints are made on heavy albumen paper carefully washed to prevent fading. The price has been put as low as possible.

PRICE LIST.

The plates will be delivered in Baltimore or New York (or will be sent by express or mail, securely packed, at the charge and risk of the purchaser), at the following *net* prices:—

The set of seven plates, unmounted, $10; mounted on cloth, $14.—Single plates, $2 each; mounted on cloth, $2.50.

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HERBERT B. ADAMS, Editor.

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RECENT PUBLICATIONS.

Photograph of the Normal Solar Spectrum. Made by PROFESSOR H. A. ROWLAND. (Baltimore, Johns Hopkins University, 1886).

[From a letter to *Science*, New York, December 18, 1885].

The photographic map of the spectrum, upon which Professor Rowland has expended so much hard work during the past three years, is nearly ready for publication. The map is issued in a series of seven plates, covering the region from wave-length 3100 to 5790. Each plate is three feet long and one foot wide, and contains two strips of the spectrum, except plate No. 2, which contains three. Most of the plates are on a scale three times that of Angström's map, and in definition are more than equal to any map yet published, at least to wave-length 5325. The 1474 line is widely double, as also are b_3 and b_4, while E may be recognized as double by the expert. In the region of the H line these photographs show even more than Lockyer's map of that region. Negatives have also been prepared down to and including the B group, and they may be made ready for publication, one of which shows eleven lines between the D lines. A scale of wave-lengths is printed on each plate, and in no case does the error due to displacement of the scale amount to one part in fifty thousand. The wave-lengths of over 200 lines have been determined to within one part in five hundred thousand, and these serve as reference lines to correct any small error in the adjustment of the scale. The great value of such a map lies not only in the fact that it gives greater detail and is more exact than any other map in existence, but that it actually represents the real appearance of the spectrum in giving the relative intensities and shading of groups of lines so that they are readily recognizable. The photographs were taken with a concave grating six inches in diameter, and having a radius of curvature of 21½ feet, and the photographs were taken when the plate was placed directly opposite the grating; both the sensitive plate and grating being perpendicular to a line joining their centres, and placed at a distance apart equal to the radius of curvature of the grating, the slit being on the circumference of the circle, whose diameter is the distance between the grating and plate. With this arrangement, the spectrum is photographed normal for wave-lengths without the intervention of any telescopes or lens systems; and a suitable scale of equal parts applied to such a photograph at once gives relative wave-lengths.

Few persons have any idea of the perseverance and patience required to bring such a task to a successful issue. More than a year was devoted to preliminary experiments designed to discover the best mode of preparing the plates for the particular regions to be photographed. Hundreds of preparations were tested to find their influence on the sensitized plate, and the whole literature of photography was ransacked, and every method tested to the utmost, before the work of taking the negatives could begin.

The prices of the plates have been fixed as follows:

For the set of seven plates unmounted, $10; mounted on cloth, $12. Single plates, $2 each; mounted on cloth, $2.25. A prospectus will be sent on application. (See p. 39 of *Circular* 45).

Reproduction in Phototype of a Syriac Manuscript (Williams MS.) with the Antilegomena Epistles. Edited by ISAAC H. HALL. (Baltimore, Johns Hopkins University, 1886).

[From an article by I. H. Hall in the Journal of the Society of Biblical Literature and Exegesis for 1885, with additions].

In September last (1884) I announced in *The Independent* the discovery of a manuscript of the Acts and Epistles, among which occur also the Epistles that were *antilegomena* among the Syrians; namely the Second Epistle of Peter, the Second and Third Epistles of John, and the Epistle of Jude, in the version usually printed with our Peshitto New Testaments. It is well known that the printed copies of these Epistles in that version all rest upon one manuscript only, in the Bodleian Library at Oxford, England, from which they were first published by Edward Pococke (Leyden, Elzevirs) in 1630. That edition, with various editorial conjectures, is the parent of all the printed texts. In a former article in the Journal of the Society of Biblical Exegesis and Literature I have already expressed my opinion that they actually belong to the Philoxenian version.

By hunting over the catalogues of manuscripts in the European libraries, I found that the Pococke MS., though the only one practically known to the critics, is not absolutely the only other known MS. copy containing that version of these epistles. All that are known at present are about six or seven in number, and are of values greatly varying; some being copies of others, and one being nothing more than a copy of the printed text of the Paris Polyglott. But this one found by me is the second one likely to be available to the critics.

The manuscript was obtained some fifteen years ago by the late Rev. William Frederic Williams, then missionary to Mardin, by whom it was sent to his brother, Robert S. Williams, Esq, of Utica, New York, who is its present owner. Mr. Williams kindly placed the MS. at my service for examination and study; when I discovered the nature of its contents. Just where the MS. was obtained it is now impossible to say, as Mr. Williams' missionary work kept him on continual journeys. It was obtained from an aged priest, who probably parted with it only because he was unable to read it.

The MS. is written on cotton paper, *charta damascena*, in a rather western Syrian hand, in two columns to the page, and regularly twenty-five lines to the column. One leaf, the first, is now gone; but it originally contained 150 leaves (of its proper matter), and two leaves more for a poem at the end. The size of the leaf is 10½ by 7½ inches; of the columns, 8½ by 5 inches. The quires are *quiniones* in the first part of the book, but in the latter part they are *quaterniones*, except the last, which is a *ternio*. While most of the manuscript is written on paper of double thickness, some portions are written on paper of single thickness, which, probably from the glazing, has a darker color than the rest, and allows the ink to show through. But all is of the same age, as appears by many proofs. A later hand has numbered the folios, in Syriac numerals. The MS. appears to be in its original binding (except a new back), leather, with a flap; the board within the leather being composed of older Syriac MSS.

The contents of the MS. are as follows: Tables to find the movable feasts, and also of the church-lessons from the Acts and Epistles; then the Acts and Catholic Epistles, and the Pauline Epistles, in the usual order, ending with Hebrews. At the end of the Epistles is a colophon which says that it was finished at noon on Thursday, the fourth of the sultry month Tammuz, in the year of the Greeks 1782; which answers to our July 4th, 1471; which day indeed fell on a Thursday. After the colophon follows a poem of 128 lines, all ending with the same syllable (but hardly rhyming according to our ideas), consisting of a hymn to the Trinity, and a narrative of the construction of the manuscript. The scribe conceals his own name, but shows himself to be a stranger in the land where it was written. The poem is worth quoting at length for its matter. * * * *

From various internal reasons I have been inclined to suppose that the scribe was one of the St. Thomas, or Malabar Syriac Christians, on a visit to his western brethren; one of a set like those later comers, who wrote the Leiden Apocalypse and a few other MSS. extant in Europe. The poem at the end calls the writer a layman, and uses the far-eastern term "*Sahib*" to characterize one of his friends. . . . . and tells who furnished the paper, and who paid for the writing. The prayer . . . includes other benefactors; among them his two grandmothers and his mother, who brought him up and paid the expenses of his education; besides a number of others whom he specifies by name as having helped him in his place of exile, and been "diligent to establish his living without impediment." Another part of the poem, unfortunately mutilated in a very interesting spot, speaks of the compilation of the matter of the book. . . .

However, an Arabic note at the end of the tables at the beginning of the MSS. forces us to modify the conclusion naturally drawn from this poem, and to consider the present manuscript not the original work therein referred to, but a *contemporaneous copy* thereof. The Arabic note states that one Daûd esh-Shâmi il-Homsi (David the Syrian of Homs, or Hamath) had found this excellent work, owned by Suleimân (the name spelled Selimûn in the Syriac poem), at the city of El-Keifa; and finding it so much better than any MS. of the Acts and Catholic Epistles he ever saw (and he had seen many), as well as containing *seven* Catholic Epistles, which he had never seen before, and all divided into their chapters and sections, provided with lessons, notes, etc., and its most accurately supplied vowels and points, had brought it to Husn Keifa, and obtained a copy for his own use, made by Suleimân's own hand. Husn Keifa, as the Arabic geographers give it, was a fortress overlooking the Tigris, either quite up in Armenia, or on the borders of Armenia and Mesopotamia (the doubt is not as to the site, but within which country that site was included). It is now known by the Kûrds of the region as Hus Keif. Husn Keifa is doubtless, therefore, the home both of that original which was compiled and written by the unknown scribe, and of this its copy, which was made as appears above, with proper care and under good auspices. Daûd il-Homsi would not be called "il-Homsi" at home, in Homs; and that fact goes against the supposition of the MS. having been brought westward by him. But where Mr. Williams found the MS. is no nearer discovery than before. Two Arabic marginal notes show that this copy was examined by Hassan, one of the patrons of the original compiler and unknown scribe. The fly-leaves of the MS. contain numerous scrawls in Syriac, Carshun, and Arabic, which give a few owners' names; but I have not yet made out any complete history of its possessors. A few of the scrawls are in Nestorian script.

Besides the scribe's general introduction and colophon, there is a preface to the Acts, to the Catholic Epistles as a whole, and to each of the Pauline Epistles. The preface to the Acts is avowedly (and the others are actually) taken from the "Treasure of Mysteries of Mafrianus," i. e. of Gregory Bar Hebræus. The Syrian chapters, or sections, are marked in the text by the single or double diamond of dots (except when they coincide with a church-lesson), and are numbered in the margin. The church-lesson notes are written in red in the body of the text, and also numbered in the margin. In both these series of numberings the Acts and Catholic Epistles are treated as one book, and the Pauline Epistles as another. The Syrian chapters are the same as the very ancient ones, with one remarkable exception, caused by the introduction of the four *antilegomena*. In the ancient and ordinary division the Acts and Catholic Epistles have 32 sections or chapters; section 31 beginning at 1 John, ii. 7; and section 32 at iii. 21. But in this MS. section 31 begins at 2 Peter, i. 13; section 32 at 2 Peter, iii. 8; section 33 at 1 John, ii. 21; section 34 at 1 John, iv. 2; and section 35 (the last) at 3 John, 1. The *antilegomena* thus add three sections. The church-lesson titles and numbers within these books show also that the *antilegomena* were read in church, by those who used the system here given. It may be added for the sake of those who wish to know the space occupied by these Epistles in the MS., that 2 Peter begins on fol. 57, *b*, col. 2, at the middle, and ends at fol. 60, *b*, col. 2, near the top; 2 John begins at fol. 64, *b*, col. 1, one-third of the way down; 3 John begins at fol. 65, *a*, col. 1, one-fourth of the way down; Jude at fol 65, *b*, one-third of the way down, and ends at fol. 66, *b*, one-third of the way down the page, its writing on this last page not running in columns, but carrying the lines across the page.

The titles and subscriptions to these Epistles are generally quite simple; that of 2 John being merely: "End. Verses forty." . . .

With regard to the *text* of these epistles, it is far better than that of the Pococke Epistles, or of the (rather poor) manuscript which he used. Almost all the places where Pococke saw error and had to emend, or to suggest emendation, conjecturally, are right in this MS. Sometimes, however, it agrees with the Bodleian MS. against the editorial conjectures. The careless, but easily made error of "in the world" for "among the people," for instance, 2 Peter, ii. 1, which ought never to have been suffered to get into the printed editions, but which is in all of them, is not in this MS.

Throughout the MS., however, the writing is voweled with great fullness and great care. The points *qushshoyo* and *ruchocho*, which show the hard or soft sounds of the *begadkepat* letters are supplied in red. And the text generally is excellent among Syriac texts. (Of course all but the *antilegomena* are of the Peshitto version). The margins are abundantly supplied with linguistic and grammatical notes, written some in Syriac and some in Arabic. The ulterior source of these notes I have not yet ascertained; some of them are wholly from Gregory Bar Hebræus; some in part from him and in part not. These notes treat of a great variety of matters; generally of vowels and points, but sometimes of differences in pronunciation between the Eastern and Western Syrians; sometimes justifying the scribe's correction of a former matter, and so on. A note at Philippians, i. 15, last word, justifies the adoption of the participle instead of the imperfect tense, in accordance with antiquity and accuracy, though against most of our printed copies.

On the whole, this MS. is very valuable for its texts and its notes; not only as a carefully edited copy of the ancient text, but as a linguistic and grammatical treatise. Its place is high among manuscripts, although the date of its writing is not so very remote. It is easy to see, from Pococke's edition, that this MS. is every way superior to the Bodleian as a copy of the antilegomena epistles. But the special points of the sort can hardly be treated of till the collation of the MS. is completed. . . .

Seventeen pages of the MS. have been reproduced by the phototype process and an introduction and brief notes have been added by the Editor. The price has been fixed at three dollars. A prospectus will be sent on application.

Archives of Maryland. (Proceedings of the Council of Maryland, 1636-1667.) WILLIAM HAND BROWNE, Editor. (Baltimore, Maryland Historical Society, 1885).

This volume, a quarto of nearly 600 pages, is a continuation of the publication of the earliest archives of the State, provided for by the General Assembly, and carried on under the direction of the Maryland Historical Society, the custodian of the original documents. It contains the proceedings of the Council of the Province during the first thirty years of its existence, and thus runs parallel with the first volume of Assembly Proceedings.

The Provincial Council, as the preface explains, was a body charged with very varied duties. It was, with the Governor at its head, the executive body of the Province; it was the representative of the Proprietary and guardian of his rights; it sat as the Upper House of the Legislature, and had a limited legislative power of its own; it was the Provincial Court and Court of Appeal. Hence the records are quite miscellaneous in character; but in this volume only those are included which properly belong to its executive duties; and which will be found not only valuable material for history, but interesting in themselves.

A copy of the Charter of Maryland, taken from the Patent Rolls in the Public Record Office, London, is prefixed to the volume; as also copies of original documents preserved in London, which throw light upon the early history of the Province.

An Introduction to the Study of Chemistry.

American Science Series; Briefer Course. By IRA REMSEN. (New York, Henry Holt & Co., 1886).

(Extract from the Preface).

In preparing this book, I have endeavored to keep in mind the fact that it is intended for those who are beginning the study of chemistry. Instead of presenting a large number of facts and thus overburdening the student's mind, I have presented a smaller number than is usual in elementary courses in chemistry; but I have been careful to select for treatment such substances and such phenomena as seem to me best suited to give an insight into the nature of chemical action. Usually the mind is not allowed to dwell for any length of time upon any one thing and thus to become really acquainted with it, but is hurried on and is soon bewildered in the effort to comprehend what is presented. I cannot but believe that it is much better to dwell longer on a few subjects, provided these subjects are properly selected.

The charge is frequently made that our elementary text-books on chemistry are not *scientific;* that is to say, that not enough stress is laid upon the relations which exist between the phenomena considered,—the treatment is not systematic. The student is taught a little about oxygen, a little about hydrogen, a little about nitrogen, etc.; and then a little about potassium, a little about calcium, etc.; and he is left simply to wonder whether there is any connection between the numerous facts offered for study. It must be acknowledged that there are serious difficulties in the way of a purely scientific treatment of chemistry, but I think that it is quite possible to treat the subject more scientifically than is customary, and thus to make it easier of comprehension to the student. I have made an effort in this direction in the book here offered to the public.

In teaching chemistry, two mistakes are commonly made. The first is that of presenting the profoundest theories of the science before the student is prepared for them. Hence they make little impression upon his mind, and he only learns to repeat words about them, without having any real comprehension of them.

The other mistake is that of giving directions for experiments without making it clear to the student why they are performed or what they teach. The result is that he sees little or no connection between the subjects treated in the text-book and the things which he works with in the laboratory.

Now, the first object of a course in science should be to develop a scientific habit of thought. This cannot be done by mere study of the theories of a science, nor by haphazard experimenting. It can only be reached by systematic study of the phenomena, and by recognizing the connection between these phenomena and the theories. At the outset the best plan is to study phenomena scientifically, and afterwards speculations may be introduced to some extent; though, in my opinion, it is better to keep these decidedly subordinate in an elementary course.

At this day it is almost superfluous to emphasize the great importance of laboratory work as a part of a course in chemistry. College authorities and school boards are beginning to recognize the necessity of this kind of work for the purpose of securing satisfactory results. A laboratory can be fitted up at slight cost in which all the experiments described in this book could be performed. It is not necessary to wait until a complete laboratory is provided. The accommodations needed are simple, and there can hardly be a college or school which could not with a little effort secure the few conveniences. Should there, however, be such a place the teacher can at least perform the experiments described. And this he had better do with not more than ten or a dozen students around him. By constantly questioning them, and getting one or another to help him, or to do the work, fairly satisfactory results can be attained.

If the students work in the laboratory it is of prime importance that they should not be left to shift for themselves. They will surely acquire bad habits of work, and will generally fail to understand what they are doing. A thorough system of questioning and cross-questioning is necessary in order that the work shall be successful. A badly constructed piece of apparatus should not be allowed, and cleanliness should be insisted upon from the beginning. The instructor should be as watchful in the laboratory as in the recitation-room, and should be as exacting in regard to the experimental work as the teacher of languages is in regard to the words of a lesson. A badly performed experiment should be considered as objectionable as a bad recitation or a badly written exercise. When teachers of chemistry acquire this feeling, and work in this spirit, the educational value of laboratory courses will be greater than it frequently is now. The average playing with test-tubes and precipitates is of questionable benefit. As it has been dignified by the undeserved name of scientific training, and put forward in place of the real thing, many thinking men have been led to question the value of scientific training, and to adhere to the old drill in grammatical forms and mathematical problems. I do not wonder at this, but I should be greatly surprised to find this state of mind continuing after really good laboratory courses are provided. A slovenly laboratory course in chemistry is a poor substitute for a well-conducted course in mathematics or languages. It behooves those who are convinced of the great advantages to be derived from laboratory courses to see to it that these courses are conscientiously conducted. . . .

Dutch Village Communities on the Hudson River.

By IRVING ELTING. (Johns Hopkins University Studies in Historical and Political Science: Fourth Series, No. 1, pp. 68. January, 1886).

No two rivers have been oftener compared than the Rhine and the Hudson; indeed, the Hudson has been frequently termed the "Rhine of America." Between these rivers there exists, unnoticed by the traveler and unnoted, for the most part, even by the historian, a bond of union formed by the institutional relationship of the village-communities which have had their existence, with similar customs, similar laws, and similar forms of government on the banks of each stream.

Turning to the old world one finds that, notwithstanding the encroachments of the feudal system, the earlier, freer, community-life, with the customs of common land-tenure and of government by freemen met in general assembly, survived in some of the more secluded portions of the country,—notably in the forest regions of the lower Palatinate east of the Rhine, and in those northern provinces of the Netherlands,—Friesland, Groningen, and Drenthe,—whose free peoples Rome never conquered and whose right of self-government no haughty baron ever suppressed.

From Holland and the German Palatinate, where the feudal system had never gained the foothold which it had secured in France, and even in more distant England, came the first settlers who were to lay the foundations of New York state. A short sighted policy on the part of the States-General of Holland led to the granting (under the charter of "Freedoms and Exemptions," as it was called) of a monopoly, in both land and trade to the West India Company, and to the establishment, in true feudal fashion, of "seignorial fiefs," or manors, on the banks of the Hudson. The beginnings of governmental life in New Netherland were, therefore, unfortunate for the growth of free institutions. All the more noteworthy and commendable is the persistent and successful struggle of the "sturdy and independent yoeman" of Holland in fighting his way towards free representative government, in the face of the difficulties which beset him.

The details of this struggle for popular rights in and about New Amsterdam, show that the Dutch brought to the new country a rich heritage in their love of liberty, which unfavorable conditions could not crush out. More liberal charters were granted by the States-General, and as early as 1641 came the recognition of the people's voice in affairs of government, by the election, in popular Assembly, of "Twelve Select Men,"—all emigrants from Holland. The step towards freedom gained at this time was never lost; the representatives of the people repeatedly demanded, for New Amsterdam and the neighboring settlements, the municipal privileges to which the Dutch were accustomed, and in 1646 the inhabitants of the village of Breuckelen (now Brooklyn) were given the right of electing two schepens, or magistrates, with full judicial powers as in the Fatherland. Those who opposed the magistrates in the discharge of their duties were to be deprived of all share in the common lands adjoining the village.

Thus, side by side with the growth of free institutions in early New York, is to be found a common land-tenure, accompanied by many of the customs of the Germanic village community. Everywhere existed the ancient pound and the distinction between meadow-land, woodland, and the "bouweries," or "home-lots." What is now City Hall Park in New York, bounded by Broadway, Nassau, Ann, and Chambers streets, was, as late as 1686, perhaps much later, known as the village commons, where the droves of cattle were sent morning and evening to pasture.

These village rights of common land-tenure were accompanied in New Amsterdam by rights of common participation in the deliberative assembly of the people, as was the case in the forests of Germany centuries before. But the principle of popular representation was not fully recognized in the province, until the danger of English conquest induced the Governor and his Council to call the assembly of 1664, for which two deputies were elected by plurality votes of the inhabitants of the various towns. Even such a popular assembly as this, however, was not able to resist the tide of events which, in September, 1664, swept New Netherland from the hands of the Dutch and placed it under English rule.

This change in government had little effect upon the character of the population, or upon their village customs; the Dutch element predominated to such an extent that the English language did not supplant Dutch as the language of the people until about the beginning of the present century, and the records in the offices of the Clerks of Ulster, Orange, and Dutchess counties, show that the common lands held by the various communities were not, in most instances, divided into individual holdings until about the same time.

Soon after the English took permanent possession of the country, two village communities—the adjoining towns of Hurley and New Paltz, respectively Dutch and Huguenot in their origin—arose on the west side of the Hudson river, not quite a hundred miles from its mouth. Both of these villages present features peculiarly interesting to the student of institutional history.

The Hurley Commons, granted by royal patent to a number of Dutch settlers in 1709, existed for a century, under conditions which forbade any sale of a share in the land to one not an inhabitant of the town. When, in 1806, the towns-people petitioned the Legislature of the state for a division of these common lands, the partition was made, in true Teutonic fashion, according to the needs of the inhabitants,—a definite share being given to each person "as shall have supported a family and resided within the said corporation the term of two years next before making such partition and who shall during that time have followed some trade or occupation," though he had never before been a freeholder of Hurley. Even if this does not show a "periodic partition," it gives evidence of that distinctive feature of ancient communal land-holding,—the use of a portion of the common domain for "distribution among new families."

The town of New Paltz, lying just south of Hurley was, in 1677, granted by patent covering some 36,000 acres, to twelve proprietors,—all of them Huguenots. The patentees are said to have been called the "Twelve Men," or "Duzine," and to have had both legislative and judicial powers in town affairs. Three years before the death of the surviving patentee,—Abraham, son of Louis Du Bois,—the twenty-four proprietors of the New Paltz entered into an agreement, dated April 21, 1728, which established the local government of the "Twelve Men" by popular election, and authorized them to fix titles "according to the severall Divisions and partitions that have been made between them [the patentees] by Parole without deed, and the other parts thereof yet remaining in Common and undivided . . . within the bounds of the aforesaid Pattent." The "Twelve Men," under their authority conferred in the agreement of 1728, to lay out the land to be divided "in Twelve equal shares and Divisions soe that the one is not of more vallue than the other," had the lots set off regularly, from time to time, of the same size and shape, adjacent and numbered from one to twelve in each Division,—the north and south Divisions together constituting one long strip (or Tier) of similar lots, running, for the most part, north and south, parallel to the Wallkill. Almost all deeds of New Paltz property, executed after the signing of the agreement of 1728 and before the general partition of the lands by the state Legislature at the beginning of the present century, contain some reference to this method of division.

About a hundred years after the granting of the patent, fifty-two proprietors of the New Paltz, for the common defence of their territory, entered into an agreement, dated April 30, 1774,—a fact which shows both the persistence of their village community customs and the extent to which the sub-division of the common property had been carried.

Even after an act of the Legislature incorporated the township under the state government, the inhabitants of New Paltz met yearly in popular assembly to choose their "Twelve Men." There remains record of the election of these officers as late as the year 1824, and one of their number, Daniel DuBois, lived until 1852. Thus he, as the survivor, has the unique distinction of perpetuating in his own person, beyond the middle of the nineteenth century, an institution older than the Christian era.

The settlement of New Paltz, entirely Huguenot at first, received the Dutch element (destined to play an important part in the town's history) in the person of Roeloff Elting by his marriage with Sara DuBois in 1703; and it is a significant fact in the history of local institutions, that these two stocks of the early New Paltz settlers came respectively from the German Palatinate and the province of Drenthe in Holland, where to-day in the clearings of the Odenwald and on the marshy peat-fields of Drenthe, are to be found almost perfect types of the primitive Germanic mark.

From the banks of the Rhine the germs of free local institutions, borne on the tide of western emigration, found here, along the Hudson, a more fruitful soil than New England afforded for the growth of those forms of municipal, state, and national government, which have made the United States the leading republic among the nations. Thus in a new, and historically important, sense may the Hudson river be called the "Rhine of America."

The patent which included the present site of Yonkers was granted to Van der Donck, and had no connection with Rensselaerswyck closer than that arising from the fact that the patentee had been the Schout Fiscal of the Van Rensselaer manor.

Many old Dutch words survive in local expressions found to-day among people who have lost knowledge of the original meanings. In a portion of the paper, reference is made to the fact that what is now so familiarly known as the Bowery in New York City, is so called because it was the "bouwerie" or home-lot of Gov. Stuyvesant.

One who examines the records of the counties where the early settlers were Dutch will be struck with the frequency, in deeds executed before, and for many years after, 1700, of the word "vly" or "fly," used apparently in each instance to describe a low-lying piece of ground.

The word "kill" survives in the Wallkill at New Paltz, the Fallkill at Poughkeepsie, the Fishkill farther south, the Catskill farther north, and in numerous other small tributaries of the Hudson.

If the descendants of the Dutch knew the tongue of their ancestors who called every creek of importance a "kill," we should not hear, as we often do along the Hudson, such a tautological expression as "Fallkill creek."

The Teaching of the Apostles and the Sibylline Books. By J. Rendel Harris. (Cambridge, Eng.: Wallis, 1885. 2s.).

(From the *American Journal of Philology*, No. 23, October, 1885).

Professor J. Rendel Harris, one of the most esteemed collaborators of this Journal, has published a special treatise on the Teaching of the Apostles and the Sibylline Books (Cambridge, Eng.: H. W. Wallis, 1885), in which he has undertaken to show among some of the Sibyllists a very close acquaintance with the "Teaching of the Apostles." Of course critics might turn this round and say that the coincidences show a very close acquaintance of the author of the Teaching with the Sibylline Books, but this is met by attacking the date assigned to the Second Book, in which more than sixty per cent. of the coincidences occur. This reopens the question of the date of the Pseudo-Phokylides, a large part of whose poem has been inserted in the text of the Second Book. Bernays made the superior limit in time of the *ποίημα νουθετικόν* from which the Sibyllist borrowed, to be the circulation of the LXX translation of the Scriptures, while the inferior limit is furnished by the absence of all traces of the N. T. and of Christianity, say the time of Nero. This statement of Bernays that there is no trace of the early Christian *διδασκαλία* in Ps. Phokylides is met by Professor Harris with a strong negative. Ps. Phokylides "can only by extremely rough criticism be divested of sentiments which are either Christian or differ very slightly therefrom; and the whole tenor of the writing is exactly what can be explained by the first century." Professor Harris's pamphlet is full of interest to the student of that remarkable document, the *Διδαχή*, the admirable edition of which by M. Sabatier (Paris, Fischbacher, 1885) has been waiting so long on the table of this Journal for an adequate review that a review is hardly needed, as its distinguishing features have already found hearty commendation among those who are best qualified to judge. It is to M. Sabatier that we must turn when we wish to understand the connexion between the *Διδαχή* and the synagogue.

American Journal of Philology. Edited by PROFESSOR GILDERSLEEVE. Vol. VI, No. 2. Whole No. 22. (Baltimore, 1885).

Article I.—Contributions to a History of the French Language of Canada. By A. M. ELLIOTT.

In this number the writer first gives an account of the ample materials for the history, political and personal, of Canada, and especially of the inestimable church registers, which enable the student of language to disentangle the threads of dialectical influence by tracing the settlers to their original homes, whether in Northern or Southern France.

The linguistic problem is a complicated one, and is more closely connected with the historic growth of the people than is usually the case where the original population is drawn from the same general territory. Hence the necessity of this preliminary, historical article, in which the story of Canada is told in outline, from the first expedition under Jacques Cartier, in 1534, down to the Act of Confederation in 1867. Especial stress is laid on the deep religious sentiment that animated the founders of the French colony in Canada, a sentiment that survives in the extraordinary faith of the people to-day. The first conquest of Canada by the English, in 1629, gave a check to immigration, and the great majority of those who had settled in New France returned to their native country, but after the restoration of Canada to France, in 1633, the current again set in from the mother country and continued to flow uninterruptedly until another break came by foreign occupation in 1760. Immigration then ceased, but the increase of population has been phenomenal. During the last century and a quarter the growth has been more than thirty-fold, and the French people of Canada now number about two millions. Up to the surrender of Quebec the speech had been pure French, for the Indian dialects had little influence on the French language of Canada, and we only have to distinguish between the strong Northern French element with Southern French modifications. Henceforward we have to take into account the influence of English, introduced and supported as it was by special authority. But this influence is felt chiefly in the maritime districts, where the British principally settled, and the French language is everywhere aggressive. The French population now occupies seven-eighths of Lower Canada, and the French language has thrust out the English among people of English or Scotch stock.

Another important feature is the seigniorial tenure that prevailed for above two centuries and a half throughout Lower Canada. This feudal institution proved to be a remarkable system for the creation of a peasant proprietary, and there is abundant evidence that the relation of the seigneur to his people was much more intimate in the early settlement of Canada than in the mother country. Indeed, the effects of association with persons of the best culture have remained in the manners of the *habitant* up to this day. The seigneurs departed, but the priest remained, and the French nationality of Canada has grouped itself about the clergy. The working line laid down for the exploration of the French language of Canada measured one hundred and eighty miles. In this wide territory a surprising uniformity of speech was found, and the causes of this homogeneousness are to be sought in the social and political influences, in the antagonisms of religion to race, which have done much to weld together the otherwise discordant elements of this population. (Compare *Circular* No. 35, p. 20).

Article II.—Arm-pitting among the Greeks. By GEORGE LYMAN KITTREDGE.

An ancient Greek, if he murdered a man, sometimes mutilated his victim in a peculiar way known as μασχαλίζειν or arm-pitting. The extremities of the hands were cut off, strung together, and fastened under the arm-pits of the corpse by a band or girdle round the neck. There are two main theories as to the purpose. According to the former the μασχαλίζειν was a part of the ἀφοσίωσις. The cut off extremities were the ἀπαρχή of the victim, a sin-offering to the infernal gods to expiate the murder.

According to the latter the mutilation of the body was supposed to effect a corresponding mutilation of the soul, so that the shade, deprived of its limbs, would be powerless to take vengeance on the criminal. It is the latter view that Mr. Kittredge advocates, formed on the basis of a close examination of the *loci classici*, and next by a long array of evidence from the history of culture.

Article III.—Pharsalia, Pharsalus, Palaepharsalus. By B. PERRIN.

The conclusion reached by the writer may be stated in his own words: "I consider it certain that both camps were on the right of the Enipeus, somewhere near the main route between Pharsalus and Larissa, and that the battle was fought at the base of the hills on whose slope Pompey's camp was pitched, near Palaepharsalus. I consider it probable that Palaepharsalus was on the hills north of the Enipeus and west of the main road north and south, that Pompey's line of battle extended east and west, parallel with the Enipeus, and covered on the right by a small stream running from the hills into the main river. This also makes Göler's position for Cæsar's camp the more probable one."

Article IV.—Greek and Latin Inscriptions from Palestine. By FREDERIC D. ALLEN.

Sixty-six inscriptions copied by Rev. Dr. Merrill in the years 1875–77 in the course of journeys undertaken under the auspices of the American Palestine Exploration Society. The most interesting of them has been published already, *American Journal of Philology*, III, p. 206. According to Professor Allen No. 5, together with No. 17, fixes the era of Gerasa, provisionally at least, in the spring of 44 A. D.

The *Reviews* and *Book Notices* relate to *Zimmer's Keltische Studien* (J. M. HART); *Cook's Sievers' Old English Grammar* (JAMES W. BRIGHT); *Abbott's Evangeliorum Versio Antehieronymiana* (J. RENDEL HARRIS); *Uhlig's Dionysii Thracis Ars Grammatica* (B. I. WHEELER); *Gatschet's Migration Legend of the Creek Indians*, and *Brinton's The Lenâpé and their Legends* (C. H. TOY); *Robinson Ellis' Anecdota Oxoniensia*, and *XII Facsimiles*, and *Bréal and Bailly's Dictionnaire Étymologique Latin* (MINTON WARREN); and *Jahn's Gregorii Palamae Prosopopoeia* (A. S. G.)

Reports are made of *Neue Jahrbücher für Philologie und Paedagogik, Rheinisches Museum, Revue de Philologie, Archiv für Lateinische Lexikographie und Grammatik*, and *Germania*.

Under *Brief Mention* are found notices of *Merriam's Herodotus, Hübner's Exempla Scripturae Epigraphicae, Wilkins's Epistles of Horace, Keller and Häussner's Horace, Verrall's Studies in Horace*, and *Holden's Plutarch's Gracchi*.

Recent Publications. Books Received.

Vol. VI. No. 3. Whole No. 23. (Baltimore, 1885).

Article I.—The Siṣ *and* Sa *Aorists (6th and 7th Aorist-forms) in Sanskrit.* By W. D. WHITNEY.

These *siṣ* and *sa* forms of sigmatic aorist are quite exceptional in their occurrence as compared with the other two, the *s*-aorist and the *iṣ*-aorist. In the whole body of Sanskrit literature, there are found to occur 145 *s*-aorist stems, (of which 99 appear only in the older language, 9 only in the later, 37 in both), and 174 *iṣ*-aorist stems (123 in the older language, 16 in the later, 21 in both); of the other two classes, less than a score each. After giving the details Professor Whitney comes to the conclusion that the *siṣ*-aorist and the *sa*-aorist are both sporadic in their character, *sa* in just the same degree as *siṣ*.

"The analogy of *ádikṣam* and *ĕδειξα*, which has given such satisfaction to beginners in comparative philology, and seemed to explain so much, has a deal of fallacy about it. The true analogue of *ádikṣam* would be *ĕδιξον*." The true factors in Sanskrit with which we have to work in studying the genesis of the sigmatic aorist, are the *s*-aorist and the *iṣ*-aorist, and these alone. "In respect to the sibilant, and to its occurrence with or without a preceding *i* . . . this aorist-formation agrees with the *s*-future and with the desiderative. Until good evidence to the contrary can be shown, these three must be regarded as related formations, and no explanation can be accepted as satisfactory for one of them which does not apply also to the others."

Article II.—Remarks on Vol. II of Kock's Comicorum Atticorum Fragmenta. By ROBINSON ELLIS.

Notes on some fifty fragments to most of which emendations are proposed.

Article III.—Vowel-length in Old English. By ALBERT S. COOK.

A continuation of the article Vowel-length in King Alfred's Orosius, published in the *American Journal of Philology*, Vol. V, pp. 318–324. Several corrections of the previous article are given.

Article IV.—On the so-called Genitive Absolute and its Use especially in the Attic Orators. By EDWARD H. SPIEKER.

According to Dr. Spieker the most plausible view of the genitive absolute construction is that which is advocated by Holzweissig in his Syntax and which refers it to the use of the genitive in expressions of time, as in νυκτός, a use which dates far back in I. E. languages, being found in Vedic Sanskrit as well as in the earliest Greek. By the use of a participle with such a geni-

tive and the gradual emphasis of the participial element, the construction could have been easily and naturally evolved.

After an elaborate discussion of the views of Classen who starts from the genitive partieiple without a noun, the writer follows the history of the construction in Homer, Hesiod, the lyric poets, and the drama. In Homer, the statistics of Classen are accepted. The others are only touched on, not exhaustively treated. In the domain of Attic prose, oratorical usage is presented with great fulness in accordance with the title of the paper. The orators show marked differences in the use of this construction, both as to frequency and as to manner. The early orators, Antiphon and Andokides, use it in a simple, easy way; no case of ὡς or of ἄν, no relative or interrogative pronoun as subject, etc. In Lykurgos we find the same state of things; there are but few exceptions to it in Lysias and Isaios. To these the use in Isokrates, Demosthenes, Aeschines, and Deinarchos presents a striking contrast. The paper, which is too full of detail to admit a satisfactory abstract, ends with a brief comparison between the Greek genitive absolute and the Latin ablative absolute, and emphasises the freedom and variety of the Greek use as one of the many evidences of what this gifted nation could make out of the linguistic material it possessed.

Article V.—Two Points in French Style. By P. B. Marcou.

The two points are the gradual shortening of the French sentence and the shifting position of adjective and substantive. As to the latter peculiarity ("prédestination éternelle," "éternelle prédestination") we learn that on the one hand there is a strong tendency to use preposition less and less, while on the other hand it is used less frequently for euphony and more frequently to excite the fancy. A liberty which was formerly made use of for euphony alone, has been taken advantage of for a much higher purpose, and we have here an instance of how the persistent cultivation of style is tending to make the language a more and more delicate instrument.

Mr. Nicholas Murray Butler has presented in a *Note* the statistics of *The Postpositive* et *in Propertius.*

In the *Reviews and Book Notices* are discussed *Wagner's Marlowe's Tamburlaine* (James W. Bright), *Sweet's First Middle English Primer, Skeat's Tale of Gamelyn, Jahresbericht über die Erscheinungen auf dem Gebiete der Germanischen Philologie* (J. M. Garnett), *Reid's Cicero's Academica, Abraham's Studia Plautina* (M. Warren), *Stengel's Theatre d'Alexandre Hardy* (A. M. Elliott).

The *Reports* relate to *Mnemosyne, Anglia, Rheinisches Museum, Neue Jahrbücher für Philologie und Paedagogik, Romania,* and *Hermes.*

In *Brief Mention* a short account is given of *Iwan Müller's Handbuch der klassischen Altertumswissenschaft, C. E. Schmidt's Parallel-Homer, Dionysios Thereianos' Φιλολογικαὶ Ὑποτυπώσεις, Baebler's Beiträge zu einer Geschichte der lateinischen Grammatik im Mittelalter, Westcott and Hort's Small New Testament* (school ed.), *Holzweissig's Lateinische Schulgrammatik, Furneaux's Tacitus' Annals, Schenkl's Bibliotheca Scriptorum Graecorum et Romanorum, J. Rendel Harris's Teaching of the Apostles and the Sibylline Books, Sabatier's Διδαχή, Flagg's Seven against Thebes.*

Recent Publications. Books Received.

Small Differences of Sensation. By C. S. Peirce and J. Jastrow.

[Abstract from the Memoirs of the National Academy of Sciences, Vol. III].

The physiological psychologists assume that two nerve excitations alike in quality will only produce distinguishable sensations provided they differ in intensity by an amount greater than a fixed ratio (the *Unterschiedsschwelle*). Another theory, does not admit an *Unterschiedsschwelle,* but claims that the multiplication of observations will indefinitely reduce the error of their mean. If there be a least perceptible difference, then when two excitations differing by less than this are presented to us, we ought to answer which is the greater, wrong as often as right in the long run. Whereas, if the theory of least squares is correct, we not only ought to answer right oftener than wrong, but we ought to do so in a predictible ratio of cases.

We have experimented with the pressure sense, observing the proportion of errors among judgments as to which is the greater of two slightly different pressures. From the probability, thus ascertained, of committing an error of a given magnitude, the probable error of a judgment can be calculated according to the mathematical theory of errors. If, now, we find that when the ratio of the two pressures is smaller than a certain ratio, the erroneous judgments number one-half of the whole, while the mathematical theory requires them to be sensibly fewer, then this theory is plainly disproved, and the maximum ratio at which this phenomenon is observed the so-called *Unterschiedsschwelle.* If, on the other hand, the values obtained for the probable error are the same for errors varying from three times to one-fourth of the probable error, then the theory of the method of least squares is shown to hold good within those limits, and the presumption will be that it extends still further. The mathematical theory has the advantage of yielding conceptions of greater definiteness than that of the physiologists, and will thus tend to improve methods of observation. Moreover, it affords a ready method for determining the sensibility or fineness of perception, for, knowing the number of errors in a certain number of experiments, and accepting the conclusions of this paper, the calculated ratio to the total excitation of that variation of excitation, in judging which we should err one time out of four, measures the sensibility.

Throughout our observations we noted the degree of confidence with which the observer gave his judgment upon a scale of four degrees, as follows: 0 denoted absence of any preference for one answer over its opposite; 3 denoted as strong a confidence as one would have about such sensations; while between the two, 1 and 2 naturally found their places.

The apparatus used was an adaptation of a "Fairbanks" post-office scale, with various accessory appliances which had as their object the avoidance of delay and fatigue, as well as of any jar or inequality in the operation of applying and removing the variable pressure. Each experiment consisted of three operations, in the first and third of which the same pressure was brought upon the finger of the subject, while in the second a slightly smaller or slightly greater pressure was substituted. The object of this double change was to avoid the well-known difference of sensation excited by an increase and decrease of pressure.

	Ratios of pressures. [Subject: Mr. Peirce.]		
	1.060	1.030	1.015
Average number of errors in set of 50.....	10.4	19.3	21.6
Calculated from probable error = 0.051....	10.7	17.2	21.0
Average confidence.			
Observed.....	0.7	0.3	0.2
Calculated.....	0.7	0.3	0.2

Comparing in the accompanying tables the average number of errors in a set of fifty with the theoretical value of this average as calculated by the method of least squares, we see that the correspondence between the real and the theoretical numbers is close.

The experiments in which Mr. Jastrow was the subject were much more extensive, and cannot all be grouped in one table, because the probable error is on the decrease throughout. They can be conveniently grouped in four tables, two of which are given below:

	Ratios of pressures. [Subject: Mr. Jastrow.]		
	1.060	1.030	1.015
Average number of errors in set of 50.....	11.0	13.8	20.8
Calculated from probable error = 0.050.....	10.4	17.0	21.0
Average confidence.			
Observed.....	0.85	0.5	0.3
Calculated.....	0.9	0.4	0.2

	Ratios of pressures. [Subject: Mr. Jastrow.]		
	1.020	1.010	1.005
Average number of errors in set of 50.....	12.8	17.7	20.7
Calculated from probable error = 0.020.....	12.5	18.3	21.6
Average confidence.			
Observed.....	0.12	0.07	0.00
Calculated.....	0.12	0.06	0.03

The tables show that the numbers of errors follow, as far as we can conveniently trace them, the numbers assigned by the probability curve, and therefore destroy all presumption in favor of an *Unterschiedsschwelle.*

The evidence of our experiments seems clearly to be that this sensation has no *Schwelle,* and vanishes only when the difference to which it refers vanishes. The general fact gives new reason for believing that we gather what is passing in one another's minds in large measure from sensations so faint that we are not fairly aware of having them, and can give no account of how we reach our conclusions about such matters.

American Journal of Archæology.

Vol. I, No. 4. (Baltimore, A. L. FROTHINGHAM, JR., Ph. D., Managing Editor, 1885).

I.—Marble Statue of Artemis in the Museum at Constantinople. By SALOMON REINACH (with one plate).

This is one of the most remarkable pieces in the Tchinly-Kiosk Museum, and represents the goddess with her right arm resting on a pilaster, her left hand on her hip, and the right leg crossed over the left. The writer considers it a Greco-Roman copy of an original of the time, if not by the hand, of Praxiteles.

II.—Law Code of the Kretan Gortyna. By A. C. MERRIAM.

This inscription, which has been recently discovered by Dr. Halbherr, is the most important document yet found for a knowledge of Greek law. It relates entirely to the *jus privatum*: the condition of slaves; family regulations; the disposition of property; etc. During the last few months monographs upon it have appeared in Germany, France and Italy. The present article gives the first half of a critical text, a translation, and a full comment. The second half will be given in the next number.

III.—Mosaic of the Façade of San Paolo fuori-le-mura of Rome. By A. L. FROTHINGHAM, JR.

This mosaic which, after the fire of 1823, was taken down, divided, and placed in the interior of the church, is shown not to be the work of Pietro Cavallini, but to have been executed a century before his time, under Popes Innocent III and Gregory IX. Cavallini's work was merely restoration.

IV.—Inscribed base of an archaic bronze statue from Mt. Ptous. By SALOMON REINACH (with one plate).

This *boustrophedon* inscription reads ΤΙΜΑΣΙΦΙΛΟΣΜΑΝΕΘΕΚΕ-ΤΟΤΤΟΛΟΝΙΤΟΙΠΤΟΙΕΙΗΟΤΡΑΟΓΓΕΙΟΝ. The first part is, clearly, "Timasiphilos has dedicated me to the Ptoian Appollon": the end is an enigma, which M. Bréal proposes to read *ὄφρα ὀφείλων* "en sa qualité de débiteur."

V.—The Monoliths of San Juan Teotihuacan, Mexico. By W. H. HOLMES (with six figures).

The writer shows that a single monolith has "been made to do duty as an altar, a pillar, a 'fainting-stone,' a sacrificial stone, and a god of the Aztecs, taking in literature three separate uncorrelated guises at one and the same time." A second monolith of less importance, hitherto inedited, is also illustrated.

VI.—The Revival of Sculpture in Europe in the thirteenth century (II). By A. L. FROTHINGHAM, JR. (with one plate).

In Italy Niccola's influence on contemporary artists was short-lived; and Giovanni, the founder of the Pisan type, borrowed largely from Northern Gothic, which exercised a strong influence on the entire school. A comparison with French sculpture, on the score of invention, drapery, etc., the study of the nude and of the antique, points in general to the superiority of the latter as well as to its priority in the Revival.

Notes, by M. Reinach, on Sterrett's "Inscriptions of Assos;" and by W. M. Ramsay, on his own "Notes and Inscriptions from Asia Minor."

Revue de la Numismatique Grecque et Romaine, by ERNEST BABELON. An exhaustive and comprehensive review of the articles and monographs recently published on Numismatics in reviews and periodicals.

Correspondence.—Congrès Archéologique de France à Montbrison, by X. (an account of the excursions made by the Congress in the Forez). Excavations in Malta, by John Worthington.

Reviews and Notices of Books.—E. Müntz's *Donatello*, and Fortnum's *Christian Gems*, by C. C. Perkins. E. Molinier's *Dictionnaire des Emailleurs*, and Caruana's *Hypogeum Tal-Licbru*, by A. L. Frothingham, Jr.

Archæological News.—AFRICA (Egypt, Tunisia); ASIA (Cambodia, Hindustan, Arabia, Palestine, Phœnicia, Armenia, Persia, Asia-Minor); EUROPE (Greece, Italy, Malta, France, Spain, Switzerland, Belgium, Germany, Austria Hungary, Turkey, Roumania, Russia, Norway, Great Britain); AMERICA (United States).

Summaries of Periodicals.—Antiqvarisk Tidskrift—Archäologische Zeitung—Bulletin Monumental—Bullettino della Commis. Archeologica Comunale di Roma—Ἐφημερὶς Ἀρχαιολογική—Gazette Archéologique—Månadsblad—Mittheilungen d. Deutschen Archäol. Inst.—Revue Archéologique—Revue de l'Art Chrétien—L'Art.

Archæological Congresses.—Congress of the French Archæological Society—Congress of Belgian Societies at Antwerp.

PROGRAMME OF VOLUME II, 1886.

During 1886 contributions from England, France, Germany, Greece, Italy, Sweden, Malta, and India are expected, in the form of articles, correspondence, or notes. Special attention will be given to the part devoted to archæological news and to the summaries of periodicals.

The SECOND VOLUME will include the following articles: PROF. MERRIAM will complete his learned study on the Kretan Laws, and will publish some almost unique painted Egyptian steles owned in New York; J. T. CLARKE, the explorer of Assos, will illustrate a proto-ionic capital found in the Troad, important for the origin of the Ionic order, and will contribute other papers illustrating the work of the late expedition to Assos; PROF. RAMSAY will continue his *Notes and Inscriptions from Asia Minor;* DR. CH. WALDSTEIN will write on differences in the style of Skopas and Praxiteles, and on the Etruscan sarcophagi at Boston, one of which is of unique importance; he will also explain the plan on which the collection of casts from antique sculpture in the Museum at Cambridge, England, has been formed, etc.; J. MENANT, the noted Assyriologist, will illustrate some of the most important of the Babylonian and Assyrian cylinders in American collections, especially at the Metropolitan Museum, N. Y.; DR. W. H. WARD is to publish some antiquities studied or purchased by him during his journey through Babylonia; S. REINACH will contribute one or more papers illustrating some of the antique sculpture at the Museum of Constantinople; DR. A. EMERSON will write on the Athena Parthenos; E. BABELON is to give a full account, in the several issues, of the recent discoveries at Susa, in Arabia, in Phœnicia, and in Assyria, as well as a review of recent books on Numismatics; F. TRAWINSKI's contribution will give an account of the numerous archæological societies in France; DR. FROTHINGHAM will continue his *Notes on Christian mosaics*, and will publish some inedited documents; and other papers on Christian archæology will be contributed by L. DUCHESNE, O. MARUCCHI, and E. MOLINIER. Scandinavian antiquities will be treated by the authoritative pen of PROF. HANS HILDEBRAND, of Stockholm. Other original papers and correspondence are expected from the distinguished German archæologists, FR. VON REBER, TH. SCHREIBER, and W. HELBIG. The latest discoveries and investigations in India will be reported on by MR. ROBERT SEWELL, those in Rome by PROF. O. MARUCCHI, and those in Greece will probably be described by PROF. ALLEN. Several contributions are expected from investigators in the field of American Archæology, notably from W. H. HOLMES and V. MINDELEFF of Washington, and from F. W. PUTNAM and LUCIEN CARR of Cambridge.

Modern Language Notes.

The first of a series of "MODERN LANGUAGE NOTES" issued by A. M. Elliott, Managing Editor, and H. A. Todd, J. W. Bright, and J. Goebel, Associate Editors, has recently been printed in Baltimore.

The following statements are reprinted from the announcement of publication by the Editors:

These "Notes" (issued as the private enterprise of the editors) are "intended to satisfy, as far as may be and in a modest way, the want felt among the professors and teachers of modern languages for some special organ of communication, by giving succinct original articles, by furnishing short reviews of the chief American and foreign new publications, by calling attention briefly to the meetings of literary and learned societies, by noticing topics of personal interest, such as the work of individual scholars, changes in the *personnel* of our colleges, current papers or articles by modern language instructors, newly announced courses of study, etc. These 'Notes' will be especially adapted to the use of teachers and will contain, therefore, in addition to the above, short discussions of pedagogical questions, particularly of such as bear upon the academic study of the languages in question.

"By modern languages are here meant primarily the English, German and Romance idioms, in their earlier as well as later phases, though the treatment of other forms of living speech will not be excluded.

"The desire of the editors is to give to this little periodical as scientific a character as may be possible, considering the present status of modern language study in America. The volume will consist of a series of eight numbers, beginning with January and continuing monthly through the year, with a vacation interval from July to October inclusive. Each number of the present volume will contain at least twenty-four columns of printed matter. The price to subscribers is one dollar per annum. Price per number, twelve cents. Subscriptions may be sent to the managing editor."

THE STUDENTS' "HOUSE OF COMMONS"

OF THE JOHNS HOPKINS UNIVERSITY.

CONSTITUTION AND BY-LAWS.

CONSTITUTION.

Article I.—Name.

The name of this society shall be "The Hopkins House of Commons."

Article II.—Object.

The object of this society shall be the promotion of the art of debate.

Article III.—Membership.

Section 1. All students in regular attendance on the Johns Hopkins University, who are not members of any other similar organization in that institution, shall be eligible as regular members of this society, when nominated by the Executive Ministry.

Section 2. The duties and privileges of regular membership in this society, once assumed, can be renounced only by resignation, under the conditions, and in accordance with the rules hereinafter set forth; or by the final termination of the member's connection with the Johns Hopkins University as a student.

Section 3. For the election of regular members of this society a vote of the majority of the members present at any regular meeting shall be required.

Section 4. A willful absence from four successive meetings of the society shall be considered equivalent to an accepted resignation, and shall exclude a member from all privileges as such. Excuses for absence may be offered to the Executive Ministry, who shall be constituted judges of their validity.

Section 5. Honorary members of the House, with the privilege of debating, may be elected by a two-thirds vote of the members present at any regular meeting of the House, on the nomination of the Executive Ministry.

Article IV.—Outline of Government.

Section 1. The executive government of this society shall be vested in an Executive Ministry, a Speaker, and a Sergeant-at-Arms.

Section 2. The Executive Ministry shall consist of a Prime Minister, a Secretary for Foreign Affairs, and a Home Secretary. The Prime Minister shall be appointed by the Speaker, in accordance with rules hereinafter set forth, the Secretary for Foreign Affairs and the Home Secretary by the Prime Minister.

Section 3. The Speaker shall be elected by a majority of votes cast by ballot of the members present at the first regular meetings in October and February, and shall hold office until his successor shall have been installed.

Section 4. The Sergeant-at-Arms shall be appointed by the Speaker to serve during his term of office.

Section 5. The Speaker shall also appoint a Clerk to serve during his term of office.

Article V.—Duties of Officers.

Section 1. It shall be the duty of the Executive Ministry to propose bills for discussion by the House, to direct the order of proceedings in the House, and to act as its executive committee in carrying out all business not entrusted to any other committee.

Section 2. It shall be the duty of the Prime Minister to appoint the Secretary for Foreign Affairs and the Home Secretary, to act as chairman of the Ministry, and to draft for presentation to the House all questions decided upon by them.

Section 3. It shall be the duty of the Secretary for Foreign Affairs to conduct the correspondence of the House, and to act as its representative or agent in all dealings with outside bodies or individuals.

Section 4. It shall be the duty of the Home Secretary to see that the rooms of the society are prepared for its use, and to supervise the Clerk of the House in the keeping of the minutes and records of the society, and in preparing the business docket.

Section 5. The speaker shall preside over all meetings of the society; shall construe and enforce the constitution and by-laws of the society, and the rules of practice, subject always to an appeal to the House; shall appoint the Prime Minister, Sergeant-at-Arms, the Clerk, all special committees ordered by the House, and all officers pro tempore; and shall perform all other duties usually pertaining to presiding officers.

Section 6. It shall be the duty of the Sergeant-at-Arms to act as the ministerial agent of the Speaker in enforcing order.

Section 7. The Clerk shall keep a full and exact record of the proceedings of the society, and an alphabetical roll of the members of the society; shall carefully preserve all its records, and all documents that may be entrusted to his keeping; shall transcribe, in a book kept for that purpose, all additions and amendments to the constitution and by-laws of the society; and shall keep and announce in order a full business docket. He shall be in everything subject to the supervising authority of the Home Secretary.

It shall be the duty of the Clerk to post on one of the University bulletin boards, three days previous to every regular meeting of the House, a notice stating the heading of the next two bills on the docket.

All persons, on being elected members of the Hopkins House of Commons, shall be informed of the fact within forty-eight hours, by the Clerk, in writing. If the initiation does not take place within three weeks such election shall be declared null and void.

Article VI.—Regular Business.

Section 1. It shall be the duty of the Executive Ministry and the privilege of any member to propose questions for discussion by the House.

Section 2. Every question must be introduced in the form of a written bill, and must pass through the regular course of three readings and consideration, either by a special committee, or the committee of the whole.

Section 3. No bill shall pass through more than two readings at the same meeting of the House.

Section 4. Bills proposed shall be put upon the docket by the Clerk in the order of their presentation, which shall be the order of their consideration, unless otherwise ordered by a vote of two-thirds of those present at any regular meeting of the House.

Section 5. Bills may be introduced by private members only by leave of the Executive Ministry after at least one week's notice given of the intention to introduce a bill, and of the character of the measure to be proposed. Similar notice must be given by the Ministry of the introduction of bills to be proposed by themselves.

Section 6. The Home Secretary shall keep the Ministry advised of the state of the docket; the Ministry shall see that the discussion of pending bills is facilitated; and shall refuse leave to introduce a bill only when its introduction would inconveniently crowd the docket, unless the bill proposed be of a sort which they think out of keeping with the purposes of the society.

Section 7. All motions concerning the appointment of special committees, or expressing the opinions of the House as to the course of the Ministry, or as to any other matter not proper for the form of a bill, must be submitted in writing, and signed by the mover.

Article VII.—Responsibility of the Ministry.

Section 1. The Executive Ministry shall be responsible to the House for their opinion on all bills concerning political questions, and upon all propositions affecting the business of the society, or the amendment of the constitution. If, at any time in a vote upon such questions, they shall be left in a minority, they shall be expected to place their resignations in the hands of the Speaker, before the next regular meeting of the society.

Section 2. It shall be the duty of the speaker to accept such resignations, and to appoint a new Prime Minister from the majority represented in such a vote; and the Prime Minister so appointed shall choose his colleagues from the majority which he represents.

Section 3. The House may at any time pass a direct vote of want of confidence in the Ministry, under the form of a resolution; and upon the passage of such a resolution the Ministry shall resign and be replaced as directed in sections 1 and 2 of this article.

Article VIII.—Resignation of Membership.

Section 1. Whenever any member wishes to resign, he shall signify his desire in writing to the Executive Ministry, stating fully his reasons, and upon obtaining their acquiescence, may withdraw.

Section 2. The Ministry shall be responsible to the House for the exercise of this, as for the exercise of all their other prerogatives.

Article IX.—Collection and Expenditure of Moneys.

Section 1. The Prime Minister shall have control of all the moneys contributed by the House.

Section 2. At the beginning of his term of office the Prime Minister shall, under the title of Budget, submit to the House in writing an estimate of the expenses of the House for the ensuing three months.

Section 3. The Budget shall be considered by the House in a committee of the whole under the title of "The House Committee on Appropriations," and the Budget, when accepted by the House, shall afterwards be cast by the Prime Minister into the shape of resolutions, which shall, for their adoption, pass through the regular course of three readings and a committee of the whole.

Section 4. If the Budget be rejected, or any appropriation contained therein be refused by a vote of the House, the Ministry shall resign, and such vote shall be considered as a direct vote of want of confidence.

Section 5. After the Budget has been accepted by the House, the Prime Minister shall submit to the House in writing a plan for raising the moneys appropriated by the Budget.

Section 6. The plan of the Prime Minister for raising the moneys appropriated by the Budget shall be considered by the House in a committee of the whole under the title of "The House Committee of Ways and Means;" and the plans sanctioned by this committee shall afterwards be cast by the Prime Minister into the shape of resolutions, which shall for their adoption pass through the regular course of three readings, and a committee of the whole.

Section 7. At the expiration of his term of office, and at the expiration of the Speaker's term, each Prime Minister shall submit to the Speaker a written statement of the expenditures of the House for his term of office, and of the then condition of the finances of the House.

Section 8. At the expiration of his term of office the Speaker shall submit to the House a written statement of the expenditures of the House during his term of office, and of the then condition of the finances of the House; such statement to be compiled from the statements of the Prime Minister.

Section 9. At any time at the written request of two-thirds of the members of the House, the Speaker shall be authorized to require from the Prime Minister such a statement, which he shall submit to the House.

Article X.—Changes in Constitution and By-Laws.

Section 1. All motions and resolutions affecting the constitution or by-laws of this society shall be submitted in writing and pass through three readings and a committee of the whole; and not more than two readings shall be taken at one sitting of the House.

Section 2. A unanimous vote of the members present at a regular meeting of the society shall be necessary to amend this constitution; but a vote of two-thirds of the members present at any regular meeting shall be sufficient to amend the by-laws.

Section 3. Two-thirds of the members present at any regular meeting of the society may, by a single vote, suspend for that sitting any provision of the by-laws.

BY-LAWS.

Article I.—Meetings.

Section 1. The House shall meet every Monday evening during the session of the University at eight o'clock p. m., with power of adjournment for any period by a two-thirds vote.

Section 2. The Speaker shall call special meetings of the House at the request of the Executive Ministry or of ten members of the Society.

Section 3. If, after having been properly requested to do so, the Speaker fail to call a meeting of the House, the Executive Ministry or a quorum of members may convene it, after having given twenty-four hours' notice of the time and object of the meeting. Notice posted upon two of the University bulletin boards shall be sufficient if signed by the members of the Ministry, or by a quorum of the members of the Society.

Article II.—Quorum.

One-third of the members of the Society shall constitute a quorum for the transaction of business.

Article III.—Order of Business.

1. Roll-Call.
2. Reading, correction, and adoption of minutes of the last meeting.
3. Installation of officers.
4. Nomination, election, and initiation of new members.
5. Election of officers.
6. Regular order of docket business.
7. Motions and resolutions.
8. Notice by the Ministry of the introduction of measures.
9. Notice by private members, after leave asked and obtained of the Ministry, of introduction of bills.
10. Notice of election of officers.
11. Adjournment.

Article IV.—Miscellaneous Business.

Section 1. The Speaker shall give notice of every election of officers at least one week before it is to take place.

Section 2. To adjourn before the regular order of business has been completed shall require a vote of two-thirds of the members present. The motion to adjourn shall be debatable.

Section 3. At the request of five members a rising vote shall be taken; at the request of ten members the vote shall be taken by Yeas and Nays.

Section 4. The rules of parliamentary practice, as set forth in Roberts' "Rules of Order," shall govern the proceedings of this society in so far as they are not inconsistent with any provision of its constitution or by-laws.

Article V.—Form of Initiation.

The Speaker shall request the newly elected member (or members) to come forward and sign the constitution, and shall then address him (or them) in the following words:

"Sir, (or Sirs),—You have voluntarily become a member (or members) of this society, and I have therefore, in its name, to lay you under the most solemn injunctions to obey and uphold its constitution; to observe all propriety as a member and a gentleman (or as members and gentlemen); and to advance by a strict adherence to duty the object of its organization."

Article VI.—Speaker's Decisions.

Section 1. The House may at any time, by a majority vote, require within one week a written decision from its Speaker on any point with reference to the government of the House, or on the interpretation of its constitution. Said decisions when presented to the House by the Speaker shall lie over for one week, when the House shall adopt, amend, or reject the same, as it sees fit.

Section 2. In case the House adopts the same as a whole, or with amendments, said decision as adopted shall be recorded in a book kept for that purpose, and the decisions thus recorded shall be signed by the Speaker and the Clerk.

RECENT DISCUSSION OF THE SOCIETY'S CONSTITUTION.

(From a letter by MR. LANGDON WILLIAMS in *The Nation*, N. Y., No. 1065, November 26, 1885).

. . . The literary societies of our colleges are chiefly of two sorts—either devoted to the reading of essays and other similar literary productions written by the students, or else devoted to formal debates on subjects of small general interest. Societies of both these sorts have been tried at the Johns Hopkins University, all commencing most promisingly, but invariably dying a natural death within a few months. Interest flagged after the first few meetings, while the students had too much to do to spend time in preparing essays or reading up for fixed topics of debate.

Last year, however, at the suggestion of one of the Fellows in History, a new departure was made. At a mass-meeting the students decided to establish a deliberative assembly, resembling, as much as possible, the English House of Commons. The proposer of the scheme prepared the draft of a constitution, on the model of one he had seen working at another college, which was adopted, with some few alterations, by the students. The "Hopkins House of Commons" was incorporated. The officers were to be as follows: (1) a speaker elected twice a year, who was to have all the duties of the same officer in the English House of Commons, and, besides, the executive power of appointing the prime minister; (2) a prime minister, who was always to belong to the majority of the house; (3) a foreign secretary and (4) a home secretary, who were to assist the prime minister in deliberation and debate—the two secretaries being appointed by the prime minister. The speaker was also to appoint a sergeant-at-arms for the preservation of order, and a clerk to note the proceedings.

With this working machinery, bills are introduced and put through all the readings and forms of a deliberative assembly, and adopted or rejected according to the disposition of the house. The Opposition benches are, as a rule, almost as full as the ministerial seats, causing the rivalry to be very active and the interest unflagging. Meetings are held every Monday evening at eight o'clock, and the house seldom adjourns before eleven. The attendance is very large, often reaching twenty-five or thirty, while an excellent rule, that four successive absences shall be equivalent to a resignation, insures constant, consecutive attendance. The second year has opened with a membership almost doubled, which is not confined to undergraduate students alone, for the roll contains the names of a number of graduate students.

. . . In closing, I will add the names of some of the bills which have been introduced and debated: Bill 3, on the Nicaragua Canal; Bill 4, Local Option; Bill 5, Increase of U. S. Navy; Bill 10, to admit ex-Presidents to the Senate. . . .

(From a letter by "J. H. U., '83" in *The Nation*, N. Y. No. 1066, Dec. 3, 1885).

. . . In times past great difficulty has been experienced in getting the students together for this and kindred purposes, mainly from the fact that they are scattered throughout the city, and do not find conventional debates sufficiently alluring to entice them from their homes. In addition, the various courses of study prescribed by the University leave but little time to read up the many abstruse questions submitted for discussion. For the same reasons it has been found almost impossible to place secret societies on a firm basis, the social attractions of the outer world rendering such organizations superfluous. Under these circumstances, the establishment of a mimic Lower House, where all the forms and ceremonials are gone through with, and embryo Gladstones and Parnells "move the previous question," was a very happy thought.

But would it not have been better to model it on our own House of Representatives—a body assuredly in no wise inferior to the British House of Commons in dignity, ability, or influence? Apart from an interest in home institutions thus fostered, it would familiarize our future statesmen with the forms of procedure practised in Congress, and prove of incalculable benefit to them in after life. The Johns Hopkins University has never, hitherto, been accused of Anglomania. It is preëminently *sui generis*—a little Germanic in its predilections, if you like, but liberal and catholic withal. This broadness, however, should not be carried to the extent of developing Parliamentarians at the expense of Congressmen; for although the matter discussed may as your correspondent says, make "good citizens and intelligent voters," the manner of consideration is not in consonance with American institutions.

(From an editorial article in *The Evening Post*, N. Y., December 3, 1885).

. . . It is objected by a correspondent whose letter we print elsewhere that American students should take as their model the Senate or House of Representatives, and he would be right but for one thing. The rules of the House of Representatives are nearly all made with the view of confining the preparation and discussion of bills to the committee rooms, and shortening or preventing debate on them in the House. Debates in that House accordingly are now rare and excite little attention, and above all want the personal element which nearly every great debate in the House of Commons possesses. The Ministry being the author of all or nearly all legislation, the defeat of a bill means not simply its rejection, but the expulsion of its authors from power. In other words, the debate has a dramatic dénouement which increases enormously the interest and excitement of the discussion. In our House of Representatives as well as in the Senate, on the other hand, nobody in particular being responsible for legislation, nobody suffers or gains in emolument or credit by its failure or success. The effect of this on the character of our Congressional oratory everybody knows. The speeches are mostly essays, carefully written out beforehand, listened to by nobody, and really intended for the *Congressional Record*.

The great objection to the old debating societies was that they cultivated facility in speaking without doing much for knowledge or thoughtfulness. The subjects selected were usually subjects for an essay rather than a speech—that is, were often far beyond the scope of contemporary interest, and, at all events, rarely afforded an opportunity to the contending orators of bringing their dispute to an issue. Whether Charles I suffered justly, or whether Washington or Cromwell was the greater man, or what are the relative merits of direct and indirect taxation, are subjects which might be debated for a month, without any other result than showing that a great deal could be said, and well said, on both sides.

In such a Parliament as that started in Baltimore, however, one side has to begin by that best of all tests of a man's comprehension of a political question, the framing of a bill to carry out his views. Of all known methods of making a hole in a windbag, of revealing to a man, as well as to his neighbors, how much he knows, or does not know, of what he is talking about, and how much and what kind of consideration he has given his subject, the best is to ask him to embody his desires in a law which will be constitutional, which will not conflict with previous legislation, which the courts can interpret, which can be easily executed, which will not derange trade or industry, and which will produce in practice all the results expected of it, and no others.

There can be no better exercise, therefore, for any one, young or old, who wants to get at the bottom of a political or economical question, to test thoroughly his own acquaintance with it, and the practical value of his own ideas about it, than preparing a bill dealing with it, and then defending and explaining it before people who do not agree with him. And there can, on the other hand, be no better preparation for the work of drafting bills one's self than criticising bills drafted by other people, in their presence, and after hearing them. And this sort of training is every day becoming more and more important because of the growing demand for the interference of the State in matters which fifty, or even twenty-five years ago, were generally considered wholly outside its jurisdiction. It is now constantly asked to meddle with currency, with railroads, with labor, and tariff, in ways which the last generation never thought of. Most of the advocates of this interference think they have settled the matter when they show that it would be humane or Christian for the State to interfere. But they rarely or never touch the greatest question of all, in what manner the State should interfere, and what would be the results near and remote of its interference. Now, if they could be seized, and organized in small committees or cabinets, and compelled to produce bills carrying out their views, and to show before critical opponents how the bill would work in a given comunity, what a flood of light would often be let in on their own minds, and how much vain speech we should be spared. . . .

In England this sort of exercise is not confined to young men in colleges. Within the last few years, we are informed, 150 of these Parliaments have been organized in London and other cities, all on the model of the House of Commons, which men of all ages and pursuits join for the purpose of participating in a thorough sifting of questions of the day in which they are interested, and which have not yet made their way into Parliament, and finding out what they do *not* know about them. . . .

(From a letter by "A Member of the Hopkins House of Commons," in *The Nation*, N. Y., No. 1067, Dec. 10, 1885).

. . . Your correspondent (J. H. U., 1883) having admitted the superiority of a mimic constitutional assembly over the stereotyped literary society, suggests as a model the House of Representatives, in preference to the British House of Commons. In vindication of our choice, I deem it only necessary to point out two cardinal instances in the methods of procedure practiced by the two bodies, wherein that of the British House of Commons is better adapted to meet the requirements of a debating society than that of the lower house of Congress.

First, it presents absolutely no check to debate, and although your correspondent distinctly asserts that "it was a very happy thought" to establish a mimic House, where "embryo Gladstones and Parnells move the previous question," I would respectfully inform him that the underlying virtue of the constitution of the House of Commons, at least in so far as it concerns the case in question, is that it positively prevents "embryo" (or in fact real) Gladstones and Parnells from moving the "previous question." When, however, we compare with this the opportunity afforded for debate by the rules of the House of Representatives, we are at once opposed by an intricate system of committee legislation, . . . which has become so oppressive that, to quote a correspondent in a recent edition of the New York *Herald*, it has "crippled and disabled the House, and very greatly diminished its influence." It must therefore be evident, that to modify the rules of the House of Representatives by abolishing the various committees and the use of the "previous question" until they should conform to our needs, the identity would so far be lost that we should hope in vain to secure the object desired by "J. H. U. '83"—"to familiarize our future statesmen with the forms of procedure practiced in Congress."

Secondly, our Constitution offers continual incentive for debate, for scarcely had our "House" been organized when there at once rose a party line which has been constantly growing better defined; and inasmuch as on the defeat of a Ministry a new one *must* be appointed from the ranks of the Opposition, the one side is always striving to retain the honors and the other to win them. In a mimic House of Representatives, the only honor would be the Speakership, in which, at best, a change could only be made by election, every two or three months, while in our "House of Commons," the honors may be won at any moment by an opposition made willing and anxious to debate by the prospect of "assuming the toils of office." . . .

CURRENT NOTES.

ADDITIONS TO THE REGISTER OF STUDENTS.

(See *University Circular* No. 44, pp. 16, etc., and No. 45, p. 33).

FELLOWS BY COURTESY.

GEORGE E. BREWER. Baltimore. *Bay View Asylum.*
M. D., Harvard University, 1885. *Psychology.*

ELIAS J. MACEWAN. Agricultural Coll., Mich. 201 *W. Hoffman St.*
A. B., Kalamazoo College, 1875, and A. M. 1877; Professor in Michigan Agricultural College. *English and Philosophy.*

JOHN PHELPS TAYLOR. Andover, Mass. 258 *Linden Av.*
A. B., Yale College, 1862, and A. M., 1867; Professor in Andover Theological Seminary. *Shemitic Languages.*

GRADUATE STUDENTS.

WILLIAM A. BLAIR. High Point, N. C. 120 *N. Greene St.*
A. B., Haverford College, 1881; A. B., Harvard College, 1882. *Philosophy.*

ALFRED H. BUCHERER. Ehrenfeld, Germany. 330 *N. Eutaw St.*
Cologne Gymnasium, 1883. *Chemistry.*

GILBERT R. HAMMOND. Yellow Springs, O. 11 *Franklin St.*
A. B., Union Christian College, 1876, and A. M., 1879; Professor of Latin, Antioch College. *Latin.*

C. RICHMOND HARDING. Graham, N. C. 87 *N. Charles St.*
A. B., Davidson College, 1880. *Greek.*

CLIFTON F. HODGE. Janesville, Wis. 91 *McCulloh St.*
A. B., Ripon College, 1882. *Biology.*

EDWARD A. SCHNEIDER. Baltimore. 226 *Druid Hill Av.*
Ph. D., University of Froiburg, 1884. *Chemistry.*

CHARLES L. SMITH. Raleigh, N. C. 120 *N. Greene St.*
S. B., Wake Forest College, 1881. *History and Politics.*

JOHN M. VINCENT. Elyria, O. 35 *McCulloh St.*
A. B., Oberlin College, 1883. *History and Politics.*

CANDIDATES FOR MATRICULATION.

RICHARD C. DUNCAN. Elyria, O. 24 *McCulloh St.*
Lehigh University. *Group II.*

(1885-86. Total number now enrolled, 177 Gradnate, and 129 Undergraduate Students — 306).

ADDITIONS TO THE LIST OF PERIODICALS IN CIRCULAR 42.

The following list gives the titles of the periodicals added to the catalogue of those taken by the Library of the University since the publication of the general list in *Circular* No. 42, September, 1885. The total number of periodicals regularly received by the Library exceed 750.

American Law Review. St. Louis, Mo.
Antiquarische Tidskrift för Sverige. Stockholm.
Archivio Veneto. Venice.
Athens: École Française d'Archéologie: Bulletin.
Bibliographisch. Anzeiger f. Roman. Sprachen u. Litteraturen. Leipsic.
Botanical Gazette. Indianapolis.
Brooklyn: Long Island Historical Society: Publications.
Brookville, Ind.: Society of Natural Science: Publications.
Brussels: Société Royale Malacologique de Belgique.
Bulletin Astronomique. Paris.
Bulletin de Correspondance Hellénique. Athens.
Bulletino di Archeologia e Storia Dalmata. Spalato.
Casopis. Prague.
Christian Register. Boston.
Church Review. New York.
Correspondenz-Blatt d. Deutsch. Gesellsch. f. Anthropologie, etc. Munich.
Dorpat, Russia: Naturforsch. Gesellschaft: Publications.
Emden: Gesellschaft f. Bildende Kunst, etc.: Jahrbuch.
Εφημερις 'Αρχαιολογική. Athens.
Erlangen: Physikal.-Medicinische Societät: Publications.
Glasgow: Observatory of University: Publications.
Innsbruck: Institut f. Oesterr. Geschichtsforschung: Mittheilungen.
Journal of American Medical Association. Chicago.
Kasan: Physico-Mathematical Society: Publications.
Latine et Graece. New Brunswick, N. J.
Lincoln, Neb.: Nebraska State Historical Society: Publications.
London: Royal Historical Society: Publications.
Modena: Société des Naturalistes: Publications.
Munich: Deutsche Gesell. f. Anthropologie, etc.: Publications.
Neuphilologische Studien. Paderborn.
New England Magazine. Boston.
New Princeton Review. New York.
Nouvelles Soirées Canadiennes. Ottawa.
Nuovo Cimento. Pisa.
Observatory. London.
Occident. San Francisco.
Paris: Société de Linguistique: Mémoires.
Paris: Société d'Economie Sociale: Bulletin.
Prague: Czech Mathematical Society: Publications.
Revista pentru Istorie Archeologie si Filologie. Bucharest, Roumania.
Revue d'Assyriologie et d'Archéologie Orientale. Paris.
Revue de l'Extrême Orient. Paris.
Revue d'Ethnographie. Paris.
Revue de la Legislation des Mines. Paris.
Revue du Monde Latin. Paris.
Revue Numismatique. Paris.
Rhode Island Historical Magazine. Newport.
Riga: Naturforsch. Verein: Publications.
Sedalia, Mo.: Natural History Society: Publications.
Singapore: Straits Branch of Royal Asiatic Society: Publications.
Stockholm: K. V. Historisch. and Antiquitets Akademie: Publications.
Toronto: Canadian Institute: Publications.
Venice: R. Dep. Veneto s. g. Studi di Storia Patria: Publications.
Walford's Antiquarian. London.
Worcester, Mass.: Society of Antiquity: Publications.

LECTURES ON EDUCATIONAL TOPICS

IN HOPKINS HALL, SATURDAYS, AT 9.30 A. M.

(*Preliminary Announcement*).

The third annual course of Educational Lectures by various members of the Faculty began on Saturday, January 9, 1886.

By special request, DR. ISAAC H. HALL repeated, on that date, the substance of his lecture "on the reproduction of manuscript by typography,"—a lecture which was introductory to his public course now in progress.

The regular course will be given as follows:

January 16. D. C. GILMAN: The Obstacles and the Aids to Success in an Intellectual Life, which will be met by young Americans.
January 23. A. M. ELLIOTT: The Realgymnasium Question.
January 30. H. WOOD: The Romantic Ideal in Education.
February 6. H. B. ADAMS: History in American Universities.
February 13. ————————
February 20. R. T. ELY: The Educational Value of Trades' Unions.
February 27. E. M. HARTWELL: The Health of Students: how secured and promoted.

Lectures will also be given by PROFESSORS HALL, HAUPT, and REMSEN.

LECTURES ON SPECIAL TOPICS IN CHEMISTRY.

The annual course of lectures on special topics in Chemistry will be given in Lecture Room B of the Chemical Laboratory, on successive Fridays, at 10 a. m., as follows:

February 5, 12. IRA REMSEN: Baeyer's Investigations on the Phthaleins.
February 19. W. H. EMERSON: Investigations on the Oxidation of Ketones.
February 26. J. H. KASTLE: On Thiophene and its Derivatives.
March 5. C. W. HAYES: Fittig's Investigations on the Aromatic Hydrocarbons.
March 12. C. S. PALMER: The Earlier History of the Chemistry of Indigo.
March 19. J. R. DUGGAN: On Hydroxylamine.
March 26. J. F. WOODHULL: On Nitrification.
April 2. W. R. ORNDORFF: On Rosaniline.
April 9. E. RENOUF: On the Hydrazines.
April 16. R. N. BRACKETT: Meyer's Investigations on the Nitroparaffins.
April 23. C. J. BELL: Syntheses by means of Aluminium Chloride.
April 30. W. H. HOBBS: On the Specific Gravity of Chlorine, Bromine, and Iodine at High Temperatures.
May 7, 14. H. N. MORSE: The History of Phosphorus.

No. 2 of Volume 8 of the AMERICAN JOURNAL OF MATHEMATICS is now in press. It contains the following papers:

On the Linear Differential Equation whose Fundamental Integrals are the Successive Derivatives of the Same Function (concluded). By THOMAS CRAIG.
On Perpetuants, with Application to the Theory of Finite Quantics. By J. HAMMOND.
Note on Space Divisions. By E. H. MOORE, JR. and C. N. LITTLE.
Note on a Roulette. By A. V. LANE.
The Cubi-Quadric System. By J. HAMMOND.
On the Singularities of Curves of Double Curvature. By HENRY B. FINE.
On a Linear Differential Equation of the Second Order. By THOMAS CRAIG.

PHYSICS AT THE JOHNS HOPKINS UNIVERSITY.

(From a letter in *Science*, New York, December 18, 1885).

THE large and well-appointed laboratories recently erected by the trustees of the Johns Hopkins University for the chemical and biological departments have by contrast made the more evident the needs of the physical department, which has been obliged to occupy temporarily parts of four different buildings. The trustees, recognizing this need, are now erecting a building for a physical laboratory. The new laboratory is to be a handsome building of red brick, trimmed with brown sandstone, and will occupy a fine site about a block from the other university buildings, on the corner of a quiet little street midway between the more important streets, which carry the bulk of the traffic of that region. It will therefore be as free from disturbance from the earth vibrations as could be expected in a city.

The building will be 115 feet long by 70 feet broad, and will have four stories besides the basement. In the centre of the building, and below the basement, are several vaults for instruments requiring to be used at a constant temperature, also a fire-proof vault for storage. In these vaults will be placed Professor Rowland's dividing-engine, by which the diffraction gratings are ruled, and the Rogers-Bond comparator, which has recently become the property of the university. In the basement will be rooms for the mechanical workshop, for furnaces, and for piers for instruments requiring great stability. The first floor will include the main lecture-room, which will accommodate 150 persons, and rooms for investigations by advanced students in heat and electricity. The second floor will contain mathematical lecture-rooms, studies for instructors, and a room for the mathematical and physical library of the university.

The elementary laboratory will be on the third floor, which will also have rooms for more advanced work. The fourth floor will contain rooms for special work in light.

There will be a tower on the south-east corner of the building, which will have two rooms above the fourth floor. The upper of these will be provided with telescope and dome, and will be a convenient observatory when great steadiness in the instruments is not required. There will be power in the building for driving the machinery in the workshop and for running the dynamo-machines. A large section of the building is to be made entirely free from iron. The sash-weights will be of lead, and the gas-pipes of brass. Brackets will be attached to the walls, on which galvanometers and cathetometers may be placed. In order to avoid the inconvenience of having piers go up through the lower rooms, and yet to secure steadiness, beams have been introduced into the floors, which reach from one wall to the other between the regular floor-beams, and do not touch the floor at any point. If, now, a table is made to rest on two of these beams, by making holes in the floor over them to admit the legs of a table, it is entirely undisturbed by any one walking over the floor, except by such motion as is transmitted to the walls. There will also be a small vertical shaft in the wall of the tower, running from top to bottom, in which a mercurial manometer may be set up.

The vaults for constant temperature have been built with double walls, so that a current of air may be drawn between them whenever desirable to prevent dampness. It is expected that the laboratory will be ready by October next.

The photographic map of the spectrum upon which Professor Rowland has expended so much hard work during the past three years is nearly ready for publication. . . . (See page 41 of this *Circular*).

The Rogers-Bond comparator, which has been already referred to as having been purchased by the university lately, is one of two instruments that were constructed in 1881 by Pratt & Whitney of Hartford, Conn. The general plan and requirements were made out by Prof. W. A. Rogers of Cambridge, and the drawings and details were worked out by Mr. Georgo M. Bond, then a student at Stevens Institute. The comparator was designed for making exact comparisons of standards of length. The other similar comparator is owned by the Pratt & Whitney manufacturing company, and is used by them in testing and constructing their standard guages.

The instrument consists essentially of two microscope carriages, which slide on two parallel cylindrical steel ways between stops, which may be clamped at any point. A carriage entirely independent of the ways on which the microscopes slide, supports the two bars to be compared, and is provided with means of accurate and rapid adjustment, by which the bars may be successively brought into position under the microscopes, and the lengths compared by the micrometers attached to the microscopes; or one microscope only need be used, and slid first against the stop at one end, and then against that at the other end. The instrument also affords great facility in determining fractions of a given length with any desired degree of precision. The instrument is one requiring the utmost skill in its construction, and it cost several thousand dollars to make it. A full account of this remarkable instrument is given in the Proceedings of the American Academy of Arts and Sciences for 1882–83. K.

SIR WILLIAM THOMSON TO THE COEFFICIENTS.

(From a letter in *Science*, New York, January 1, 1886).

I know of no easier way to reach those for whom the enclosed message was especially intended than through the columns of *Science*. At the same time, I believe it will be read with great interest by many who were not of the somewhat limited number referred to. To such a brief explanation may be due: —

At the close of the course of lectures by Sir William Thomson, at Baltimore, in October, 1884, it was determined by those who, through the courtesy of the Johns Hopkins University, had enjoyed the privilege of listening to the course, to present Sir William with a memento of the occasion which had been, to them, of such unusual interest. Under the circumstances, nothing could have been more fitting for this purpose than one of Professor Rowland's large concave gratings, which was accordingly agreed upon. Several months were required for the manufacture and examination of a grating which was entirely satisfactory to Professor Rowland; but early in the past summer it was completed, and transmitted to Sir William Thomson through the kindness of the secretary of the Smithsonian Institution. Professor George Forbes of London was present during the course of lectures, and Lord Rayleigh attended a number of them. In the equations of motion developed in the work there appeared twenty-one coefficients, agreeing in number nearly, if not exactly, with the number of persons in regular attendance upon the lectures. This relation was quickly noticed by some one, and was made the basis of some humorous verses composed by the genial and witty Forbes, which were read at a reception given to the class by President Gilman, and were afterward published. Their title was "The lament of the twenty-one coefficients in parting from each other and from their much esteemed molecule."

The first stanza began: —

> "An æolotropic molecule was looking at the view,
> Surrounded by his coefficients, twenty-one or two;"

and the whole will always possess much interest to those who were present. With this explanation, I justify the title which I have given to the following selections from a letter recently received from Sir William Thomson.

T. C. M.

WASHINGTON, D. C., December 28.

SIR WILLIAM THOMSON'S LETTER.

I wrote to Professor Rowland, acknowledging the receipt of the grating; but I ought before now to have thanked all the other coefficients for their kindness in giving it to me. I should feel greatly obliged if you would transmit to those of the coefficients who are in America my heartiest thanks for their great kindness, and say to them that the grating will be a permanent memorial to me of the happy three weeks of 1884, when we were together in Baltimore. . . . After the British Association meeting at Aberdeen, I was delighted to be able to show the grating to some of our English appreciators,—including one of the coefficients, George Forbes, and Lord Rayleigh, whom we may consider as, at all events, a partial coefficient; and Professor Fitzgerald of Trinity College, Dublin; Oliver Lodge of Liverpool; Glazebrooke of Cambridge; and Captain Creak of the compass department of our admiralty,—who came to stay with us at Netherhall, our country house, for a few days, on their way south. We had no sunlight to work with, but we got the double sodium light in the first and second spectrums from a salted spirit-lamp flame exceedingly well, and we were all delighted with the result. I had never myself seen anything like it before.

WILLIAM THOMSON.

THE UNIVERSITY, Glasgow, December 5.

HOPKINS SCHOLARSHIPS.

SPECIAL ATTENTION IS CALLED TO THE FOLLOWING REGULATIONS.

Regulations amended by the Board of Trustees, January 4, 1886.

In the will of the founder of the University, his Trustees are requested to "establish, from time to time, such number of free scholarships in the said University as may be judicious, and to distribute the said scholarships among such candidates from the States of Maryland, Virginia, and North Carolina, as may be most deserving of choice, because of their character and intellectual promise, and to educate the young men so chosen free of charge."

In accordance with this request, the Trustees have established thirty-eight such scholarships, of which twenty (yielding free tuition) are designated as ordinary Hopkins Scholarships and eighteen (yielding free tuition and an annual stipend of $250) are designated as Honorary Hopkins Scholarships. Holders of scholarships are not free from laboratory fees.

Of the eighteen Honorary Hopkins Scholarships six are open to students from Maryland, six to students from Virginia, and six to students from North Carolina. The ordinary Hopkins Scholarships are open to students from any of those States. Students can be recognized as candidates only when actual residents of the States from which they desire to be appointed, during at least the year next preceding their enrolment in the university. If the appointing Board is not sure as to the legal residence of any candidate, the point in question shall be determined by the Executive Committee of the Board of Trustees.

These scholarships are all bestowed for conspicuous merit, are open only to matriculated undergraduate students from the specified States, and are tenable for the year subsequent to the appointment,—the holders being re-eligible.

Successful candidates who are disposed, for the benefit of others or for any other reason, to waive the remission of tuition fees or the other pecuniary emolument, may do so, and still have their names retained on the honor list. The scholarships may be forfeited because of prolonged absence, defective scholarship, or unworthy conduct.

Scholarships made vacant by resignation, by forfeiture, or by the non-appearance of worthy candidates at the regular times of selection may be bestowed by the appointing board, at their discretion, upon other candidates who are found worthy, provided that the principles of this foundation are not departed from. In case the holder of an honorary scholarship gives it up for any reason, during the course of a session, such part of the stipend will be paid to him as seems equitable to the Executive Committee of the Board of Trustees. The minor regulations in respect to the method of selection are to be prescribed by the Board of Collegiate Advisers.

Regulations amended by the Board of Collegiate Advisers, December 12, 1885.

I.

HONORARY HOPKINS SCHOLARSHIPS.

The Honorary Hopkins Scholarships will be awarded at the end of each academic year on the basis of the records of the year's work just completed. The three students from each of the States above named who have the best records in the regular work of the first year, and the three from each of the States above named who have the best records in the regular work of the second year, will receive the appointment, provided that number of candidates be found worthy.

II.

HOPKINS SCHOLARSHIPS.

At the beginning of each academic year, after the matriculation examinations are over, there will be held a special examination of candidates for ten ordinary Hopkins Scholarships. Students from the States above named who have just completed their matriculation examinations will be eligible.

In addition, five ordinary Hopkins Scholarships will be given at the end of each academic year to those students from the States above named, whose records in the regular work of the first year show that they stand next in order to those who have received the Honorary Hopkins Scholarships; and five ordinary Hopkins Scholarships will likewise be awarded to those whose work, as shown by the records, has been best in the second year courses.

Summary.

By the foregoing arrangements it is apparent that ten scholarships are open to students from the favored States at the beginning of the college course; fourteen (of which nine are Honorary) at the close of the first year; and fourteen again (of which nine are Honorary) at the close of the second year, tenable in all cases for the year subsequent to the appointment.

WASHINGTON SCHOLARSHIPS.

The Trustees offer two scholarships, yielding free tuition, to residents of the District of Columbia. These, like the Hopkins Scholarships, are awarded for merit, do not carry exemption from laboratory fees, and are tenable for one year, the holders being eligible for re-appointment.

At a meeting of the Board of Collegiate Advisers, December 5, 1885, it was voted "that the five vacant *ordinary Hopkins Scholarships* be given to fully-matriculated students from the States of Maryland, Virginia, and North Carolina:—*two* to the students with the best records who have completed *six* out of the nine subjects in one of the regular groups; and *three* to the students with the best records who have completed *three* out of the nine subjects in one of the regular groups."

The Board subsequently voted that no one should be appointed to an ordinary Hopkins Scholarship, the average of whose marks is less than "*good*." Upon a scrutiny of the marks the following persons were found worthy and upon them the scholarships are accordingly bestowed:

W. S. Eichelberger, of Baltimore,
J. E. Harry, of Baltimore,

who have completed the work of the first and second years;—and

R. M. McLane, of Baltimore,
J. W. Williams, of Baltimore,

who have completed the work of the first year.

H. B. ADAMS, *Secretary pro tem., Board of Collegiate Advisers.*

December 24, 1885.

HONORARY HOPKINS SCHOLARS, 1885–86.

(*Appointed*, 1883).		(*Appointed*, 1885).	
W. C. L. Gorton,	Maryland.	G. P. Dreyer,	Maryland.
W. F. Smith,	Maryland.	R. C. Gildersleeve,	Maryland.
A. C. Woods,	Maryland.	W. H. Miller,	Maryland.
(*Appointed*, 1884).		W. F. Willoughby,	Virginia.
E. C. Applegarth,	Maryland.	W. W. Willoughby,	Virginia.
T. Hough,	Virginia.		
J. H. T. McPherson,	Maryland.		
E. L. White,	Maryland.		

HOPKINS SCHOLARS, 1885–86.

(*Appointed*, 1885).		W. S. Eichelberger,	Maryland.
H. H. Ballard,	Maryland.	J. E. Harry,	Maryland.
H. M. Brown,	Maryland.	R. M. McLane, Jr.,	Maryland.
A. L. Browne,	Maryland.	C. E. Simon,	Maryland.
W. L. Devries,	Maryland.	J. W. Williams,	Maryland.

HOPKINS HALL LECTURES AT 5 P. M.

MICRO-ORGANISMS IN DISEASE.

Dr. William H. Welch, Professor of Pathology, will give nine lectures to Physicians and to students of Biology on *Micro-organisms in Disease*, beginning Wednesday, February 3, and continuing on successive Wednesdays, at 5 o'clock, until March 31.

The lectures will be illustrated by cultures and microscopic slides of pathogenic organisms.

The subjects to be considered in the lectures are:

The history of our knowledge concerning the relations of micro-organisms to fermentation and putrefaction and to disease.

The classification and biology of bacteria in general.

The methods of demonstration and of cultivation of bacteria.

General characters of infectious diseases. What is necessary in order to prove the causation of a given disease by a specific organism?

Modes of infection. Bacteria in air, ground, water, and food.

Bacteria in healthy human beings.

Micro-organisms in special diseases, such as tuberculosis, splenic fever, cholera, typhoid fever, leprosy, relapsing fever, erysipelas, pneumonia, suppurations, malaria, etc.

Diagnosis of diseases by recognition of micro-organisms.

Theories as to action of bacteria in disease. Ptomaines.

Doctrine of immunity. Attenuation of virus. Preventive inoculation.

Disinfectants. Bearings of the germ-doctrine of disease on sanitation and on the prophylaxis and treatment of disease.

GERMAN LITERATURE.

Dr. Julius Goebel, Instructor in German, will give a course of twelve lectures (*in German*) on the *German Literature of the 18th century*, beginning Tuesday, February 23, and continuing on successive Fridays and Tuesdays till April 2.

I.
Introduction.
(Tuesday, February 23).

The art of poetry.—Volks-and Kunstpoesie.—Short sketch of the development of German literature before Klopstock.—Different methods of treating the history of literature.

II.
Klopstock.
(Friday, February 26).

His life and development.—The first three cantos of the "Messias."—Impression upon his contemporaries.—Illustration by a short specimen. Criticism of the work.

III.
Klopstock.
(Tuesday, March 2).

His "Oden." The new ideas contained in them. Specimens. Criticism. Influence upon Goethe.

IV.
Lessing.
(Friday, March 5).

Life and development. Criticism before Lessing. Lessing as a critic. Literaturbriefe. Laokoon. Hamb. Dramaturgie. Theological quarrels.

V.
Lessing.
(Tuesday, March 9).

Lessing as a poet. Early dramas. Lyric poetry. His dramatic masterworks. Lessing's position in the mental history of Germany.

VI.
Herder.
(Friday, March 12).

His life and development. Hamann. Kant. Revolutionizing ideas. Volkslied, Homer, Shakespeare, the Bible. Influence upon the younger generation. Sturm- und Drangperiode.

VII.
Goethe.
(Tuesday, March 16).

His youth. Early poems. His poetic development as illustrated by them. Genieperiode. Goetz. Werther.

VIII.
Goethe.
(Friday, March 19).

Goethe in Weimar. Frau von Stein. Lyric poems. Iphigenie. Tasso. Journey to Italy.

IX.
Schiller.
(Tuesday, March 23).

His youth. Early dramas and lyric poems. Study of Kant's philosophy.

X.
Goethe and Schiller.
(Friday, March 26).

Schiller's great dramas. His ethical and æsthetic principles as embodied in his poems. Mutual influence of Goethe and Schiller.

XI.
Goethe and Schiller.
(Tuesday, April 2).

Goethe's Wilhelm Meister, Hermann und Dorothea, Balladen. Correspondence with Schiller.

XII.
Goethe's Faust.
(Friday, April 5).

General Bibliography to the Lectures on German Literature.

Schmidt, Julian. Geschichte der deutschen Literatur seit Lessing's Tod. Leipzig, 1866. II. P.
Hettner, H. Geschichte der deutschen Literatur im 18 Jahrhundert. Braunschweig, 1872. II. P.
Biedermann, K. Deutschland im 18 Jahrhundert. Leipzig, 1880.
Strauss. Kleine Schriften. Berlin, 1866. P.
Danzel. Lessing, sein Leben und seine Werke. II. P.
Schmidt, Erich. Lessing. 1886.
Haym, R. Herder, 1880–86. II. P.
Rieger, M. Klinger in der Sturm- und Drangperiode. Darmstadt, 1881.
Bernays, M. Der junge Goethe. Leipzig, 1876. P.
Grimm, H. Goethe's Leben. II. P.
Schöll, A. Goethe in den Hauptzügen seines Lebens. Berlin, 1882.
Hettner, H. Die romantische Schule. Braunschweig, 1850.
Humbold, W. v. Goethe's Herm. und Dorothea. Braunschweig, 1882. II. P.
Haym, R. Die romantische Schule. Berlin, 1870.
Dilthey, W. Leben Schleiermachers. Berlin, 1870.
Vischer, Fr. Goethe's Faust. Stuttgart, 1875. II. P.
Carière. Die Poesie. Leipzig, 1884.

RECENT DISCOVERIES IN ASSYRIA.

Dr. William Hayes Ward, of New York, Director of the Wolfe Expedition to Assyria, will give two lectures on *Recent Discoveries in Assyria*, on Thursday, February 18, and Friday, February 19, 1886.

FRENCH LITERATURE.

M. Rabillon, Lecturer on French Literature, will give a course of seventeen lectures (*in French*) on *French Literature*, beginning Saturday, January 9, 1886, and continuing on successive Saturdays to May 8.

PROFESSOR ISAAC H. HALL'S LECTURES ON THE HISTORY OF THE PRINTED NEW TESTAMENT.

(MONDAYS, TUESDAYS, AND THURSDAYS, JANUARY 4—FEBRUARY 16).

(See detailed programme on p. 29 of *Circular* 45.)

OUTLINE BIBLIOGRAPHY FOR STUDENTS.

(For a guide only; and to be enlarged and supplemented, in use, from the information and references given in the works enumerated).

(In General; to be consulted for the whole course).

(1). Prolegomena to Mill's Gr. N. T., Oxford, 1707; or Küster's Mill, Amsterdam and Rotterdam, 1710, Leipzig, 1723, 1746.
(2). Prolegomena to J. J. Wetstein's Gr. N. T., Amsterdam, 1751; or Semler's edition, 1764.
(3). Prolegomena to Tischendorf's Gr. N. Tests. of 1840, 1842, crit. maj. 1859, (Gregory and Abbot) 1884. (All Leipzig).
(4). Westcott and Hort's Gr. N. T. 1881 (Cambridge), vol. ii; N. Y. edition, Introduction to vol. i, and vol. ii, 1881, '82.
(5). Tregelles' Horne's Introduction to the Holy Scriptures, vol. iv, London, 1866, and subsequent editions. Also Tregelles' Account of the Printed Text of the N. T., London, 1854; also his Apocalypse, 1844.
(6). Reinhard, (J. B.), De N. T. Primis Editoribus, Wittenberg, 1717.
(7). Scrivener's Plain Introduction to N. T. Criticism, 3d ed., Cambridge, 1883.
(8). Reuss, (Ed.), History of the Sacred Scriptures of the N. T., translated by E. L. Houghton, Boston, 1884. (The most valuable for bibliographical references).
(9). Schaff, (Philip), Companion to the Gr. T., 2d ed., N. Y., 1885.
(10). Reuss, (Ed.), Bibliotheca N. T., Gr., Strassburg, 1872. (Most important work in the series).
(11). Hall, (I. H.), American Gr. Tests., Philadelphia, 1883.
(12). Articles in Smith's Bible Dictionary, American edition (of the highest importance for its references); Herzog and Plitt's, Meyer's, Schaff's, and other encyclopedias; Riehm's and other dictionaries, to be consulted under the proper word or subject, are usually of great value; but not to be relied on without verifying the references. The same is true of the Dictionaries of Biography and of Literature (especially of National Literature); of which the best are in French, Dutch, Latin, and German. Articles in the periodicals, old and new, are frequently the only existing sources; and by all means to be looked up when referred to in works mentioned in this Outline.
(13). Masch, (A. Th.), Le Long's Bibliotheca Sacra, Halle, 1788.
(14). Le Long, (Jac.), Bibliotheca Sacra, Paris, 1723.
(15). Baumgarten, (Jac.), Nachrichten von Merkwürdigen Büchern, and Nachrichten von einer Hallischen Bibliothek, Halle, 1748–1758.
(16). Knoch, (G. L. O.), Bibliotheca Biblica, &c., 1752; and Nachr. v. d. Bibelsammlung zu Braunschweig, 1749.
(17). Lorck, (Josias), Bibelgeschichte, 1779, '83.
(18). Goeze, (Joh. Melchior), Verzeichniss meiner Bibelsammlung, 1777.
(19). Adler, (J. G. C.), Bibliotheca Biblica, &c. Lorckiana, 1787.
(20). Bibliotheca Sussexiana, T. J. Pettigrew, 1827, 1839.
(21). Catalogues of the public and larger libraries; the great bibliographies of Brunet, Lowndes, Clark (Bibliographical Dict.), Darling, and Dibdin; with smaller works like Harwood's Classics, are of general, but less special importance here.

The older works not mentioned are in general either superseded or sufficiently referred to in the above.

For Lists of Test Readings throughout, Reuss' Bibliotheca is at present sufficient, though not now covering the entire field.

I. Introduction.

(Monday, January 4).

See particularly Introduction to (10), and vol. ii of (8). For Early Greek printing, the great works on Incunabula by Panzer and Hain. Works like Mahaffy's History of Greek Literature are useful for superficial purposes. The information is scattered, and to be picked up in special works on local matters. For other matters not above included, Erasmus's Epistles, in his Whole Works, Leiden, 1701–6.

II. The Complutensian Polyglott (1514–1517), and the work of Erasmus (1466–1536).

(Tuesday, January 5).

For Complut., (10) above; W. E. Tentzel, De Bibliis Polyglott., Wittenb., 1686; Hottinger, Bibliothecar. Quadrip.; H. van der Hardt, Memoria Ximenii, Helmst., 1717; Stuss, De Natalitiis Librorum, Göttingen, 1742; S. Seemiller, De Bibliis Complut., Ingolst., 1785; Hefele, Der Card. Ximines, Leipzig, 1871; Tregelles. Account of the Printed Text, &c., London, 1854, and (9). —— For Erasmus, (1), (2), (5), (6), (8), (9), (10); and the Biographies of Müller, 1828; Drummond, 1873; Gilly, 1879; and article by Stähelin in Herzog's Encyklop.; also Erasmus's Epistles, Autobiography, and prefaces to his various works; Delitzsch's Handschriftliche Funde, 1861, '62.

III. Complutensian and Erasmian Descendants (1519, and later).

(Thursday, January 7).

Reuss, Masch, Knoch, Mill, and Goeze, Baumgarten, Lorck, above; Birch, Praefatio ad Evv.; and the Introductions to the N. T. of Hug and Eichhorn. Also, for the Aldines; Brunet, Dibdin; A. Renouard, Annales &c. des Aldes, &c., Paris, 1834; Didot's Alde Manuce, 1873. For Gerbel; P. A. Boyesen, De Codd. Gr. Lutheri, 1723; T. Eckhard, on the same, 1723; J. G. Palm, De Codd. Lutheri, Hamb., 1735; J. F. Eckhard, An Cod. Gerbel. usus sit Luth., Isen., 1762. A book on same subject by Aug. Lichrich, Strassb., 1857. For Colinaeus, Reuss especially, also Mill, and the introductory matter to Beza's larger Gr. Tests.; Griesbach's Symbolae Criticae, and the Introductions to N. T. generally. For Van Ess, the periodical literature cited by Reuss. For the Basle printers, the best material is scattered.

IV. Robert Stephen (Estienne) (1503–1559), and his Descendants.

(Monday, January 11).

Mattaire, Hist. Stephanorum, London, 1709; A. A. Renouard, Annales de l'Imprimerie des Estienne, Paris, 1837; Reuss's art. in Herzog Encyclop.; and Knoch and Lorck, above.

For the division into verses, article by I. H. Hall in Schaff's Encyclopædia, and authorities there cited.

The London Polyglott is its own best authority (most others copy, merely); but see Schaff's Companion, and authorities cited in its foot-notes.

V. Erasmo-Stephanic and Compluto-Stephanic Descendants (1552, and later).

(Tuesday, January 12).

The bibliographies, above, are best. But see Int. to Schaff's Eng. Bible Revision, N. Y., 1873; I. H. Hall's Amer. Gr. Tests.; Thayer's Abbot's Corrections to Scrivener's Introd., Boston, Houghton, 1885. Herzog's and Schaff's Cyclopædd. of great value in the special articles.

For Plantin and the Antwerp Polyglott, see Max. Rooses, Chr. Plantin, &c., Antwerp, 1882, and Cat. of Musée Plantin, by the same; Backer and Rueleus, Annales de l'Imprimerie Plantinienne, Brussels, 1865; Degeorge, La Maison Plantin, Brussels, 1878; Annales typogr. Plantin, Bulletin du Bibliophile Belge, 1856.

For the Paris Polyglott. Le Long, Discourses historiques sur les princip. ed. des Bibles Polyglottes, Paris, 1713; Hoefer, Nouv. Biog. Générale; Kitto's Cyclopædia.

VI. Theodore Beza (de Bèsze) (1519–1605), and his Descendants.

(Thursday, January 14).

The works of La Faye, Geneva, 1606; Schlosser, Heidelb., 1809; Baum, Leipzig, 1843, 1851; Heppe, Elberf., 1861. Also, Herzog's and Schaff's Cyclopp.; I. H. Hall's Amer. Gr. Tests., and authorities there cited; and especially Reuss. Also, Dibdin, Masch, &c., for old mistakes. Also, Ezra Abbot in Introd. to Schaff's Revision of the English Version.

VII. The Elzevirs (1583–1680) and their Followers.

(Monday, January 18).

Brunet. Alphonse Willems, Les Elzevier, &c., Brux. and Par., 1880, and author. cited. Herzog's and Schaff's Cyclopp. The scattered literature is immense.

VIII. The Elzevir Descendants (1663, and later).

(Tuesday, January 19).

Chiefly scattered in the bibliographies and the biographical dictionaries. Histories of English printing, and the better bibliographies of the English Bible, to be consulted with profit. Also, R. Simon, Hist. Crit. N. T.; and especially Dibdin and Lowndes. Reuss, & Baumgarten, above; Rosenmüller, Bibl. Lit.; Hall, Amer. Gr. Tests.

IX. The Stephanic-Elzevir and Elzevir-Plantin Descendants (1633, and later).

(Thursday, January 21).

Prolegomena to Mill's, Bengel's, and Wetstein's Gr. N. Tests. The older and newer bibliographies useful; not so the Introdd. to N. T. Lowndes. Adler's accounts of his journeys and those of his fellows, in his various works pub. at Copenhagen, about 1783. Also, Whitby, Examen, 1710; Bode's Pseud.-Crit. Millio-Bengel., Halle, 1767.

X. Critical Attempts before Griesbach (1709–1780).

(Monday, January 25).

Reuss, especially, and author. by him cited, but, if possible, the original N. Tests. and their Prolegg. For Wells, Mace, and Harwood, though important, opposition has made books very rare. But see Leon. Twells, Crit. Exam. of the Late N. T., 1732; Lilienthal, Eng. Bibl.; Baumgarten, Goeze, Masch, Biblioth. Sussex.; Marsh's Michaelis, and Gregory's Eng. Prolegg. For Bentley, Jebb's life, and auth. there cited; also, especially, Gregory's Prolegg. to Tischend., and Wordsworth's ed. of the St. Germain Lat. MS. Burk's Bengel's Leben and Werken, Stuttgardt, 1831; Wächter's Bengel's Lebensabriss, 1865. Also, Herzog and Schaff, Encyclopp., Hagenbach's J. J. Wetstein, &c., in Illgen's Zeitschr. f. d. hist. Theologie, and authorities cited by Reuss. For Bowyer, Ernesti, Biblioth. theol; Brit. Magazine, II., & Encyclop. Britannica.

XI. Griesbach (1745–1812), his Opponents and Descendants.

(Tuesday, January 26).

Griesbach's own works; Prolegg. to N. Tests., Symbol. Crit., and Meletemata. Augusti, Ueber Griesb.'s Verdienste, Breslau, 1812. Reuss, above, but also his art. in Herzog; W. and Hort's Gr. T., vol. ii; Schaff's Companion. For others than Griesb., authorities cited in Reuss' Hist. N. T. Also, the various N. T. Introductions.

XII. Griesbach-Elzevir Descendants (1788–1840).

(Thursday, January 28).

Literature all scattered. Best key in Reuss, the bibliographies, the library catalogues, and periodical literature; the last, American as well as foreign.

XIII. Minor Critical Editors since Griesbach (1788–1840).

(Monday, February 1).

Reuss is best in general. See also Gregory's Prolegg., Schaff's Companion; articles in Herzog's Encyclop.; Scholz's Biblisch-Kritische Reise, and Curae Crit. in Hist. Textus Evv.; Tregelles's prefatory matter to Eng. Hexapla (in its early editions only); accounts in translations of Meyer's Commentaries; Bloomfield, Crit. Annotations to N. T. Also, recent Introdd. to N. T.; Schaff's Companion, and authorities therein cited.

XIV. Lachmann (1793–1851), and his Followers.

(Tuesday, February 2).

Studien u. Kritiken, (Heidelberg) 1830, p. 817 ff. Biography of Lachmann by Herz, Berlin, 1851; also Jacob Grimm's Rede auf Lachmann, in his Auswahl aus den Kleineren Schriften, Berlin, 1871; article by Von Gebhardt in Herzog's Encyclop.; Tregelles, account of Printed Text of N. T.; Ezra Abbot, in Schaff's Encyclop.; Schaff's Companion; Scrivener's Introd., and the later Introdd. generally. Ezra Abbot's review of Buttmann in Bib. Sac., Oct., 1858. But see Reuss's Hist. N. T.

XV. Historic editions of the New Testament, down to this point.

(Thursday, February 4).

Knowledge mostly special; and to be gathered from collections only. See, however, Reuss's Bibliotheca; Schaff's Companion; Gregory's Prolegomena; Mitchell's Critical Handbook; and the Introductions to N. T.

XVI. Tischendorf (1815–1874); his Life, Work, and Editions.

(Monday, February 8).

Reuss; Prolegomena to various editions of Tischendorf's Gr. N. Tests.; Tischendorf, Aus dem Heiligen Lande, Reise in den Orient, Die Sinaibibel, Notitia Cod. Sin.; Prolegg. to 8vo ed. of his Sin. N. T.; Anecdota Inedita; Collectio Nova; the Prolegg. to his Cod. Ephrem, Cod. Claromontan, and other works. Volbeding, Tisch. i. a. 25 jährig. schriftst. Wirksamk.; Gregory in Bib. Sac., Jan., 1876; Von Gebhardt, in Herzog's Encyclop.; Ezra Abbot in Unitarian Review, March, 1875; Schaff's Companion; Gregory's Prolegg. to Tisch. N. T.; Am Sarge und Grabe Tischendorf's, containing funeral addresses, &c. The literature is very voluminous. Thayer's article in Unitarian Review, and life &c. of Ezra Abbot, 1884; and volume "Ezra Abbot" pub. by Harvard Divinity Sch. authorities.

XVII. Tregelles (1813–1875), and the Editors of Recent Mixed Texts.

(Tuesday, February 9).

For Muralt, see especially the Prolegomena to Tischendorf's Gr. N. T., ed. Lipsiensis, secunda, 1842. For Alford, biography by his widow. For editors before Tregelles, —Reuss, Schaff, Herzog, and the N. T. editions themselves. For Tregelles, especially his Apocalypse, both Gr. and the later English, his account of Printed N. T. Text; Schaff's Companion; Gregory's Prolegg.; Art. Bibeltext, in Herzog's and Schaff's Encyclopp.; Hort, in Jour. Philol., March, 1858, and in his Gr. N. T.; Abbot, in Schaff's Encyclop.; and the later Introdd. to N. T.; Prolegg. (by Hort and Streane) to Tregelles's Gr. N. T.

XVIII. Westcott and Hort (with sketch of the past and present circulation of texts).

(Thursday, February 11).

W. and Hort's Gr. T. itself; Reuss; Von Gebhardt's Tischend. Gr. N. T. Prolegg. and collations; Gregory's Prolegg.; Schaff's Companion (esp. its Rev. Eng. N. T. literature), and introd. to his ed of W. and H.; I. H. Hall, Amer. Gr. Tests. Also, Burgon's Last Twelve Verses of St. Mark, and Revision Revised.

XIX. The Syriac Apocalypse.

(Monday, February 15).

Eichhorn's and Hug's Introdd. to N. T.; less useful are the other Introdd., except Tregelles, in vol. iv of Horne's Introd. Rosen and Forshall's and Wright's Cat. of Syr. MSS. in Brit. Mus.; Zotenberg, of those in Bib. Nat. at Paris; J. S. Assemani, Biblioth. Orientalis; Storr's Reportorium; De Dieu's Apoc.. 1627 and Critica Sacra; I. H. Hall, The Syr. Apoc., in Jour. Soc. Bibl. Exegesis, 1883–4; Tregelles's arts. Syriac Versions, &c., in Smith's Bib. Dict.; Schaff's Companion to Gr. T. Also, special works referred to in E. Nestle's Bibliography, in his Porta Ling. Syr.

XX. The Antilegomena Epistles (2 Peter, 2 and 3 John, and Jude).

(Tuesday, February 16).

Same authorities as above. Also, arts. by I. H. Hall in Jour. Soc. Bibl. Exeg. and Lit., 1883–1885; and Proceedings Amer. Or. Soc., 1880–85; White's ed. Philoxenian (really Harklensian) N. T., Oxford; Pococke's Syriac Epistles, 1630; Bernstein's Gospel of John; Adler, De Verss. Syr., and works cited by Nestle, in his "Porta." Also arts. by Nestle, Nöldecke, &c., running through the whole series of Z. D. M. G. Recent publications have so often been for private distribution only that they are very difficult of access, though very valuable. The extinct Journal of Sacred Literature is full of pertinent matter. The Abbé Martin's Introd. to N. T. is very rich, but full of flightiness, and very rare in America. The Grammars of Nöldecke, Duval, and Nestle (short) have much pertinent matter. Also art. on Syr. Bible Text by Nestle, in Herzog's Encycl., last ed.

DR. FROTHINGHAM'S LECTURES ON ASSYRIAN ARCHÆOLOGY.

(MONDAYS AND THURSDAYS, FEBRUARY 25—MARCH 10).

(See detailed programme on p. 32 of *Circular* 45).

OUTLINE BIBLIOGRAPHY FOR STUDENTS.

The following is a list of books in the Johns Hopkins (H), Peabody (P), and Mercantile (M) libraries, drawn up for the use of those who intend to follow Dr. Frothingham's lectures on *Babylonian and Assyrian Archæology*. The works have been selected not with reference to the needs of specialists, but for those who have made no special studies in this field; and they are arranged in the order of their publication, so as to show the gradual development of the study.

The archæological works which are of particular value are marked with a *; the philogical with a †.

Lassen, Chr. Die Altpersischen Keilinschriften von Persepolis. Bonn, 1836. H.
Rawlinson, H. The Persian Cuneiform Inscription at Behistun. London, 1846. P.
Botta, P. E. Lettres sur ses découvertes à Khorssbad. Paris, 1847. H. P.
Layard, A. H. Nineveh and its remains. (1st exped.). London, 1848. P. M.
——— The Monuments of Nineveh. London, 1849–53. P.†
——— Discoveries in the ruins of Nineveh and Babylon. (2d exped.). London, 1853. P.
Oppert, J. Expédition Scientifique en Mésopotamie, executée de 1851 a 1854, par MM. Fresnel, Thomas et Oppert. Paris, 1859–62. P.*
Ménant, J. Les Écritures Cunéiformes. Exposé des travaux, etc. Paris, 1864. H.
Place, V. Ninive et l'Assyrie, avec des Essais de Restauration par F. Thomas. 3 vols. fol. Paris, 1866–69. P.*
Oppert, J. Mémoire sur les rapports de l'Egypte et de l'Assyrie dans l'Antiquité. Paris, 1869. P.
Rawlinson, G. The five great Monarchies of the Ancient Eastern World. London, 1873 H. M.
Records of the Past, being English translations of the Assyrian and Egyptian Monuments. 12 vols. London, 1873–78. P.†
Lenormant. La Magie chez les Chaldéens. Paris, 1874. H.
Smith, G. Assyrian discoveries, an Account of Explorations, 1873–74. London, 1875. P. M.
Maspéro, J. Histoire Ancienne des peuples de l'Orient. Paris, 1875. H.
Halévy. Recherches critiques sur l'origine de la Civilisation Babylonienne. Paris, 1876. H.†
Smith, G. The Chaldæan account of Genesis. London, 1876. P. M. German Transl. by Delitzsch. H.†
Sayce, A. H. Lectures upon the Assyrian Language. London, 1877. P.†
Schrader, E. Keilinschriften und Geschichtsforschung. Giessen, 1878. H.
Sayce, A. H. Babylonian Literature. London, 1878. P. H.
Ménant, J. Bibliothèque du Palais de Ninive. Paris, 1880. H. P.
Birch, S. The Bronze Ornaments of the Palace Gates of Balawat (Shalmaneser II., B. C. 859–825). London, 1880. H.*
Fischer and *Wiedemann.* Ueber Babylonische "Talismane" (Cylinders). Stuttgart, 1881. H.
Delitzsch. Wo lag das Paradies? Eine biblisch-Assyriologische Studie. Leipzig, 1881.†
Kaulen. Assyrien und Babylonien nach den neuesten Entdeckungen. 2d ed. Freiburg, 1882. (3rd ed., 1885). H.
Hommel. Semitischer Völker und Sprachen. 1882. H.
Haupt, P. Die Akkadische Sprache. Berlin, 1883.†
Delitzsch, F. The Hebrew language, viewed in the light of Assyrian Research. London, 1883. P.
Assyrian Antiquities, British Museum. Guide to the Kouyundjik Gallery. London, 1883. H.
Ménant. Recherches sur la Glyptique Orientale. I. Cylindres de la Chaldée. Paris, 1883. H.*
Schrader. Die Keilinschriften und das Alte Testament. Giessen, 1883. H. P.†
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Wright, Wm. The Empire of the Hittites. With decipherment of Hittite Inscriptions by Prof. Sayce. London, 1884. H.
Sayce, A. H. The Ancient Empires of the East. New York, 1881. P.*
Sarzec, E. de. Découvertes en Chaldée. Paris, 1884. H.*

PROCEEDINGS OF SOCIETIES.

Scientific Association.

January 6.—Sixty-eighth regular meeting. Professor Remsen in the chair. Fifty-eight members present.
Papers read:
Recent Speculations on the Origin of Death, by W. K. BROOKS.
Geological Trip to Lake Superior, by G. H. WILLIAMS.
Theory of Antiseptic Action, by J. R. DUGGAN.

Philological Association.

January 8.—Sixty-sixth meeting. Professor Gildersleeve in the chair. Thirty-eight members present.
Papers read:
The Old-Indian Sibilants: 1. Preliminary remarks on the correlation of *m* and *v* in the Vedas; 2. Introduction to the study of the sibilants and the influence of sibilants upon one another; by M. BLOOMFIELD and E. H. SPIEKER.
On the Hebrew Words in the Codex Sangallensis 912, by C. ADLER.

Historical and Political Science Association.

December meetings.—Dr. H. B. Adams in the chair.
Papers read:
Introduction to a Study of the Public Domain of the United States, by S. SATO.
Rural Institutions of Yorkshire, England, by L. WILLIAMS.
Bismarck's Economic and Social Policy, by L. KATZENSTEIN.
The Pope's Encyclical Letter, by H. B. ADAMS.
Religion and Politics in Italy, by W. C. LANGDON.

Mathematical Society.

December 16, 1885.—Professor Newcomb in the chair. Seven members present.
Paper read:
Proof of the Theorem: The Deficiency of every Unicursal Curve is 0, by W. E. STORY.
PROFESSOR NEWCOMB made some remarks on Complex Anharmonic Ratio.

Baltimore Naturalists' Field Club.

December 16.—Mr. G. L. SMITH reported the results reached by the committee on the question of labelling the Park trees. Last fall this idea commended itself to the Club and several members of the botanical section were appointed to examine its feasibility. To make the public acquainted with the names of the native and introduced trees of which there is such a large collection in Druid Hill Park, is a motive which all will readily appreciate. And after considering the proposition, the Park Commissioners decided to appropriate one hundred dollars for this purpose. This sum, although inadequate to do the work as completely as might be wished, will yet enable the Club to name about 500 of the most important and conspicuous trees on the principal thoroughfares in the Park. It is intended to give in each case the scientific and popular names on the label, and to make the latter distinct but small enough so as not to disfigure the tree.
DR. J. C. HEMMETER read a popular paper on Fungi.
DR. G. H. WILLIAMS gave an account of the Geology of the State and its relation to that of the country at large.

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STANDING ANNOUNCEMENTS.

JOHNS HOPKINS UNIVERSITY.

Opened for Instruction in 1876.

The Johns Hopkins University was founded by the munificence of a citizen of Baltimore, Johns Hopkins, who bequeathed the most of his large estate for the establishment of a University and a Hospital. It was intended that these institutions should coöperate in the promotion of medical education. The Hospital buildings are approaching completion.

The foundation of the University is a capital, in land and stocks, estimated in value at more than $3,000,000; the capital of the Hospital is not less in amount.

The University was incorporated under the laws of the State of Maryland, August 24, 1867. Power to confer degrees was granted by the Legislature in 1876.

Suitable buildings have been provided in Baltimore at the corner of Howard and Little Ross Sts., and are furnished with the necessary apparatus and books.

Academic Staff, 1886.

Daniel C. Gilman, ll. d., *President of the University.*
J. J. Sylvester, f. r. s., d. c. l., *Professor (Emeritus) of Mathematics.*
Basil L. Gildersleeve, ph. d., ll. d., *Professor of Greek.*
G. Stanley Hall, ph. d., *Professor of Psychology and Pedagogics.*
Paul Haupt, ph. d., *Professor of the Shemitic Languages.*
H. Newell Martin, dr. sc., a. m., f. r. s., *Professor of Biology and Director of the Biological Laboratory.*
Simon Newcomb, ll. d, *Professor of Mathematics and Astronomy.*
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Henry A. Rowland, ph. d., *Professor of Physics and Director of the Physical Laboratory.*
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John S. Billings, m. d., *Lecturer on Hygiene.*
Léonce Rabillon, bach. ès lett., *Lecturer on French Literature.*
Herbert B. Adams, ph. d., *Associate Professor of History.*
Maurice Bloomfield, ph. d., *Associate Professor of Sanskrit.*
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George H. Williams, ph. d., *Associate Professor of Mineralogy.*
Henry Wood, ph. d., *Associate Professor of German.*
William Hand Browne, m. d., *Librarian and Associate in English.*
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Arthur L. Kimball, ph. d., *Associate in Physics.*
Henry A. Todd, ph. d., *Associate in Romance Languages.*
Philip R. Uhler, *Associate in Natural History.*
James W. Bright, ph. d., *Instructor in English.*
Henry H. Donaldson, ph. d., *Instructor in Psychology.*
Julius Goebel, ph. d., *Instructor in German.*
George Hempl, a. b., *Assistant in German.*
J. P. McMurrich, ph. d., *Instructor in Osteology, etc.*
Charles A. Perkins, ph. d., *Assistant in Physics.*
Edmund Renouf, ph. d., *Assistant in Chemistry.*
Edward H. Spieker, ph. d., *Instructor in Latin and Greek.*
Hugh Newell, *Instructor in Drawing.*
Charles L. Woodworth, Jr., *Instructor in Elocution.*

PLAN OF THE CIRCULARS.

The Johns Hopkins University Circulars are published at convenient intervals during the academic year for the purpose of communicating intelligence to the various members of the University in respect to work which is here in progress, as well as for the purpose of promulgating official announcements from the governing and teaching bodies. During the current academic year, eight circulars will be issued in successive months, to be followed at the close of the year by an index.

Although these circulars are designed for the members of the University, they have frequently been called for by institutions and libraries at a distance, and also by individuals who are interested in the literary and scientific activity of this University. Subscriptions and exchanges are therefore received.

TERMS OF SUBSCRIPTION.

For the current year, 1885–6, $1.

For the year 1884–5, (134 pp. in cloth covers), $1.50.

For the year 1883–4, (140 pp. in cloth covers) $1.50.

For the year 1882–3, (156 pp. in cloth covers), $3.

For the years 1879–82, (250 pp. in cloth covers), $5.

Subscribers to the Circulars will also receive the Annual Register and Report of the University.

All subscriptions should be addressed to the "Publication Agency of the Johns Hopkins University."

Communications for the Circulars should be sent in prior to the first day of the month in which they are expected to appear.

PUBLIC LECTURES.

Notice in Respect to the Admission of the Public.

In answer to inquiries, and in correction of some current misapprehensions, the following statements are made in respect to the public lectures given in the Johns Hopkins University.

These courses are academic lectures, designed primarily for the members of the University, and supplementary to the regular class-room work of the students.

As the members of the University rarely require the entire room, the Trustees have taken great pleasure in inviting other persons, not connected with the University, to attend.

As these lectures are not intended for popular entertainment, but for the instruction of students, those persons first receive tickets, in most cases, who are known to be especially interested in a particular course,—ladies as well as gentlemen.

There is no general course ticket issued. Applications should state specifically the course for which tickets are desired. Programmes and other current information pertinent to university work may be found in the *University Circulars*, sent to subscribers, on the payment of one dollar per annum, by the Publication Agency of the University.

The usage of giving personal notification has been discontinued, and those therefore who are interested in such announcements should hereafter consult the *Circulars*.

It will save much delay if applications for tickets and inquiries on these and other routine matters are addressed not to individuals but to the Johns Hopkins University, *by postal card*, and answers will be promptly returned by mail. Personal applications consume time needlessly.

☞ The lectures begin at 5 o'clock *punctually*. The doors of the hall are opened at fifteen minutes before 5, and the lectures do not exceed an hour in the delivery.

PUBLICATIONS ISSUED UNDER THE AUSPICES OF THE UNIVERSITY.

I. American Journal of Mathematics.

The publication of this journal commenced in 1878, under the editorial direction of Professor Sylvester, and is now conducted by Professor Simon Newcomb as Editor, and Dr. T. Craig as Associate Editor. Seven volumes of about 400 pages each have been issued, and the eighth is in progress. It appears quarterly, in the quarto form. Subscription $5 per year. Single numbers $1.50.

II. American Chemical Journal.

This journal was commenced in 1879, with Professor Remsen as editor. Six volumes of about 450 pages each have been issued, and the seventh is in progress. It appears bi monthly. Subscription $3 per year. Single numbers 50 cts.

III. American Journal of Philology.

The publication of this journal commenced in 1880, under the editorial direction of Professor Gildersleeve. Five volumes of about 570 pages each have been issued, and the sixth is in progress. It appears four times yearly. Subscription $3 per volume. Single numbers $1.00.

IV. Studies from the Biological Laboratory.

[*Including the Chesapeake Zoological Laboratory.*]

The publication of these papers commenced in 1879, under the direction of Professor Martin, with the assistance of Dr. W. K. Brooks. Two volumes of about 500 pages, octavo, and 40 plates each, have been issued, and the third is in progress. Subscription $5 per volume.

V. Studies in Historical and Political Science.

The publication of these papers was begun in 1882, under the editorial direction of Dr. H. B. Adams. A first series of 470 pages, a second of 630 and a third of 595 pages are now completed and a fourth series is in progress. Subscription $3 per volume.

The University Circulars. $1 per year.

The Annual Report presented by the President to the Board of Trustees reviewing the operations of the University during the academic year.

The Annual Register giving the list of officers and students and stating the regulations of the University. Published at the close of the academic year.

The University Circulars, Annual Report, and Annual Register will be sent by mail for one dollar per annum.

Rowland's Photograph of the Normal Solar Spectrum. Set of seven plates, unmounted, $10; mounted, $12. Single plates, unmounted, $2; mounted, $2.25. 1886.

Reproduction in Phototype of a Syriac MS. with the Antilegomena Epistles. I. H. Hall, Editor. Only 250 numbered copies have been issued. $3. 1886.

Studies in Logic. By members of the Johns Hopkins University. C. S. Peirce, Editor. (Boston: Little, Brown & Co.) 1883. 123 pp., 12o. $2.

The Development and Propagation of the Oyster in Maryland. By W. K. Brooks. 1884. 193 pp., 4o. 13 plates and 3 maps. $5.

On the Mechanical Equivalent of Heat. By H. A. Rowland. 1880. 127 pp., 8o. $1.50.

New Testament Autographs. By J. Rendel Harris. 1882. 54 pp., 8o. 4 plates. 50 cents.

Sir William Thomson's Lectures on Molecular Dynamics. 1884. 370 pp., 4o. $5.00.

All communications in respect to publications should be addressed to the "Publication Agency of the Johns Hopkins University," Baltimore, Maryland.

REPORTS OF RECENT COMMUNICATIONS TO THE UNIVERSITY SOCIETIES.

On the Manuscripts of Professor J. C. Bluntschli, of Heidelberg, in the Library of the Johns Hopkins University. By J. M. Vincent.

[Communicated to the University Seminary of History and Politics, January 22, 1886].

It is always a pleasure to trace the intellectual history of persons of note, and the interest increases when the subject of study has been a man of world-wide reputation and influence. But the attractions of biography and personal anecdote are doubly intensified when the unfolding of genius can be followed in the papers and autographic accumulations of a long and active career. Character and peculiarities are there recorded, willingly or unwillingly, under hand and seal of the man himself.

Revelations such as these, of the inward life of Johann Caspar Bluntschli await the student who acquaints himself with that collection of manuscripts which forms the nucleus of the Johns Hopkins Historical Library. The collection contains little of a strictly private or personal nature, but to the direction and extent of the public intellectual activity of the man there is many a characteristic testimonial.

The earliest reminiscences of Bluntschli's school work are three papers which date from 1825, his last year in the Gymnasium at Zürich, and consist of notes on various books of Horace, on the *Eunuch* of Terence and on Cicero *pro Archia et pro Marcello*. They cover some forty pages of the unglazed and unruled paper of the period and are written in the fine neat hand which characterized his writings to the end of his days. He says in his autobiography that his education, according to the fashion of the time, was strictly linguistic, and the statement is borne out by the name signed to these notes upon Horace, "C. Bluntschli, stud. philol.," by which title every gymnasial scholar was then known. Another interesting fact might be noted in connection with this signature. He says that his Christian names never pleased him. Johann Caspar, or Hans Caspar, as it was familiarly called, had evidently been too frequent a designation in his family. He was only partially reconciled to it from the fact that one of the three wise men of the East was said to have been called Caspar, and it is plain to be seen by what name he was known to his playmates and student friends, for, from the beginning of these papers to the end of his university career, when he could use the title of Doctor, his mark of ownership was simply "C. Bluntschli."

One other paper may well be mentioned before passing on to his professional studies. He relates that after he had been a year or so engaged in the strict methods of thinking which the Zürich Law School demanded, he became convinced that he was not what he once imagined he was, a poet. It is perhaps to be regretted that we have no specimens of his own work in this line, but we have an indication of his youthful tastes in a brief collection of the fancies of others, entitled, "Witty, Satirical, and Humorous Thoughts in Metrical Language. Epigrams," and dating back to 1823. They consist of selections from Von Logau, Herder, Goethe and others, and are copied with unusual care upon nine small pages, which might easily be carried in the pocket and furnish food for reflection, or material for quotations.

The lectures at the Political Institute, as the training school for lawyers and statesmen was called, were in fact but a continuation of his previous studies, it being but a natural step from Latin literature to Roman law. The favorite teacher in this department was the young Dr. Keller, disciple and afterward successor of Savigny. Under him in 1826–27 Bluntschli studied the History and Institutions of the Civil Law, Pandects, Institutes of Gaius, and Latin Classics, especially Cicero, upon all of which subjects copious notes testify to his interest and industry. A specimen of the student's own composition in this field remains in an essay "On the different meanings of the expression, *jus civile*, among the Romans," bearing date of June, 1827. In after life he looked back with pleasure to his introduction at this time to the Constitutional Law of Switzerland, under the patriotic leadership of Professor J. F. Meyer. These lectures are also preserved, and doubtless gave him thus early the impulse to study his own country.

The removal to Berlin in the autumn of 1827 was but another step forward in his Roman studies. Introduced by Dr. Keller, he attended with special zeal the lectures of Savigny and worked in his private library. Souvenirs of this period are bound volumes of Savigny's Pandects and Institutions, Philipp's German Constitutional History, Rudorff's Common Law of Inheritance, Böckh's Grecian Antiquities, Klenze's Roman Law, beside numerous loose manuscript comments on Latin authors and other subjects. Bluntschli was from the beginning inclined toward the newer school of Roman lawyers, of whom Savigny was the chief. On coming in closer contact with them in Berlin he became confirmed in their views, and, as one testimony of allegiance to that party, adopted the Latin handwriting. We can see for ourselves the change in chirography in passing from the second to the third volume of Savigny's Pandects. Up to this point everything is written in the old fashioned German script, but from the summer of 1882 on, with some slight hesitations, he uses the characters which we employ.

In October of that year, he joined the University of Bonn, attracted thither by the fame of Niebuhr and Hasse. With the former he entered into the newly awakened study of Roman History and preserved a thick volume of lectures as the result. In the summer this great investigator of the ancients turned his attention to the French Revolution. Upon this subject also we have a book of Bluntschli's notes, so that the library possesses both a printed and a written volume which state that the lectures were given in 1829.

Under Hasse, Bluntschli's studies took more of a Germanic turn. Many pages of notes on German Private Rights, Law of Inheritance, and similar lectures doubtless laid the foundation of subjects upon which the student himself lectured in after years. He took his degree of Doctor Juris at Bonn in 1829, submitting as a thesis a paper which was the product of his work in Savigny's library and which had already been awarded a gold medal by the Berlin faculty. The subject was the "Development of Succession contrary to the last will in Roman Law." We have no MS. of this essay, but, in place of it, an interleaved copy of the printed edition of 1829, "mein erstlings Buch," containing numerous annotations in the handwriting of the author.

After a residence of a few months in Paris, the young doctor returned to Zürich, connected himself with the courts and was soon given a position as secretary to one of the judicial commissions. Now began his practical acquaintance with the laws of his native country and soon after, his activity as a politician. The excitement of the Revolution of 1830 brought the literary ability of the rising lawyer into play and numerous productions appeared before the public. Of his books none of that date remain in MS., but another most interesting document is preserved, which has both a personal and an historical interest. It contains the minutes of the Committee on Revision of the Constitution of Zürich, of which committee Bluntschli was made secretary. To the student of Swiss History this will afford glimpses of the conflicting interests which strove for mastery in the change from the old ways to the new.

With the foundation of the University of Zürich in the spring of 1833, began our author's career as Professor of Law. At first he lectured on Roman Law. Thick bunches of MSS. on the History and Institutions, on the Pandects, on Family Law, and on interpretation of passages, bear witness to the extent of his labors. They indicate also, in their form, the change from the student to the lecturer. The narrow margins of the copyist give place to the habit, universal among German professors, of writing upon but half the page, leaving the balance for additions.

Gradually, however, Bluntschli's studies led him away from the ancient, into, what seemed to him more vital, Teutonic institutions. Especially attractive to him was the historic development of the laws of Zürich. This subject had hitherto been only superficially treated, and the young professor plunged into the unknown mass of material with the enthusiasm of fresh discovery. Archives were ransacked and ancient books re-opened. As a result a great quantity of notes have come down to us, in the way of extracts from convent records, charters, and community law books, and information on Swiss customs from all sources. Out of these researches grew his lectures on Zürich Law of Private Rights, which bear the date, "Wintersemester, $18\frac{35}{36}$." Other lectures on the law of Inheritance probably trace their origin to the same fountain, as likewise several papers on Sources of Zürich Law, City Law of Inheritance, and Marital Guardianship, the large gray foolscap form of which indicates their destiny as magazine articles.

Out of these lectures and studies grew his Legal History of Zürich, published in two volumes 1838–9. A part of a first draft of this work has been preserved in MS. Many corrections and additions indicate the care with which the book was prepared, and the printed introduction is worded still differently from the MS. copy of the same passage. The Library has also a first edition richly annotated on the margins by the writer himself. To possess this book alone might well be the pride of any admirer of Bluntschli.

Researches into Teutonic institutions in general also found a place in this period. A course of lectures on German Private Law dates from 1838, and others on the legal history of Germany probably began about the same time. Lectures on Commercial Law were read first during the winter of 1838–9, and bear half a dozen dates of repetition down to 1854.

In 1839 an article in the Halle'schen Jahrbücher "on the new historical school of German jurisprudence" attracted wide attention from lawyers and scholars. This essay lies before us in MS. Bluntschli refers to it in after life as the germ of his "Modern State." It is curious to note the difficulty he had in selecting a title. No less than five different attempts have been variously amended at the head of the first page.

Of studies in the Philosophy of Law there are traces extending over a long period. A small MS. of 1829 contains notes on the lectures of Tügge at Bonn. Later we find Bluntschli's own lectures, in which a part of the paper is old and the ink dim, while interspersed are additions and notes in modern freshness. A collection of notes on the "Conception of Law" was doubtless the groundwork of a public address in Munich in 1858, and an article on the "Doctrine of Legal Personality" was perhaps a part of the war with the old school of Roman lawyers.

Among our author's academical lectures, those on the "Constitutions of Switzerland and North America" seem to evince the latest completion, although there are pages of the MS. which might have been written early in his life. They bear no date, but may be safely assigned to the Heidelberg period, and will stand as the ripe judgment of a great statesman upon our institutions.

Besides numerous interesting reminders of Bluntschli in the way of remarks and slips of comment, scattered through the books of his library, among which an annotated copy of his "*Allgemeines Staatsrecht*" will attract especial attention, there remains one other class of MSS. to be mentioned. These are the Legal Opinions, of which a large number are preserved, dating from all points along his career. First as Counsel for the city of Zürich, his advice was sought by his fellow-citizens and by neighboring communities; then, after laying down his official position, cases were referred to him from an ever increasing circle of acquaintance. Some of these opinions bring up questions of great interest in the history of institutions. For instance, his decision was asked in a contest between the villages Bülach and Bachenbülach over the boundaries of their common lands, a case which might have come into court, when the Alamanni first divided the soil. A similar dispute came to him from Aegeri, when he had been many years away from the country. Another early paper is a petition which he drew up for citizens of Rümlang protesting against the mal-administration of the common woodlands; in another, a question of damages involves the relation of Canton Thurgau to the Confederation, and of both to the Duchy of Baden. Many opinions were on private cases involving large amounts, as that of the Rothschilds against a Swiss railway, or Lenglet against the Roumanian Railroad on which opinions had already been sought from numerous professors in Paris and Vienna. It is interesting to note how large a majority of these cases came from Switzerland, and that perhaps the greater number were submitted after he had made his home in Germany. In fact, the last decision upon which a date has been identified, was on a question sent up from his native city. An unfortunate tailor of Zürich was found drowned with his adopted daughter in the river Sihl. From a letter left it appeared that both had sought together this watery relief from care. The question arose as to who should inherit the man's property, the blood relations, or the father of the adopted child. Bluntschli decided in favor of the former and signed the opinion, "Heidelberg, 20 Febr. 1881," eight months and a day before the close of his life.

Whatever judgment may be passed upon the value of these manuscripts, whether they contain unpublished matter new to science, or, whether they have been or shall be superseded, they will always remain, for the Historical department of this University, rare memorials of scholarly progress and success, and the means of personal acquaintance with an inspiring mind.

Instantaneous Photographs of the Heart and Intestines in Motion.

By William Gilman Thompson, M. D., of New York.

[Abstract of a paper read before the University Scientific Association, February 3, 1886].

I have recently succeeded in applying the process of instantaneous photography to the study of the moving heart and intestines *in situ*. These movements are so complicated and differ so widely under varying chemical, thermic, mechanical and other stimuli, that it is of great value to have a series of photographs of normal movements to keep for comparison with results obtained by artificial stimulation or inhibition. The apparatus which I have employed consists of a Blair Tourograph camera, with a Voigtländer lens, $1\frac{3}{4}$ inches in diameter, and a simple drop-shutter which could be adapted to give an exposure of from $\frac{1}{60}$ to $\frac{1}{10}$ second. Since the photographs were necessarily taken indoors in the months of December and January, and in an ordinary room without sky-light, direct sunlight illumination of the object was the only available light which proved satisfactory with the kind of lens at command. The majority of the views of the heart were taken with an exposure of less than $\frac{1}{10}$ second. This is quite rapid enough for a pulse rate not exceeding 120 or thereabout, for there is always a brief pause at the completion of both systole and diastole. If the exposure were less than $\frac{1}{60}$ second enough light was not obtained. In some of the photographs of the intestines, the peristaltic movement here being usually much slower than in the heart, an exposure of $\frac{1}{2}$ second to 1 second was employed for the sake of greater detail. The plates used were the Stanley Gelatine, and the developer was pyrogallic acid. The animals experimented with were frogs, pigeons, rabbits, kittens and the calf.

The anaesthetized animal was nailed upon an upright board, placed in full sunlight and the chest was rapidly opened, so as to expose the heart to the greatest advantage with the least possible hemorrhage. It was found advisable to slip a little disc of white celluloid behind the heart, so as to give a strongly reflecting background to throw the heart into relief from surrounding tissues which are of much the same color. The celluloid does not at all interfere with the cardiac movements, it does not become sticky with moisture, and it is kept clean from blood by the spray of warm salt and water which is directed upon the heart to keep it from drying. A photograph was then taken of full normal diastole and another of full normal systole, as nearly as they could be judged by the eye. Intermediate views of different degrees of contraction were also taken. Some drug, such as aconite, chloral, glonoin (1 per cent.), digitaline, was then injected hypodermatically or painted upon the beating heart, and a second series of views was taken of the altered systole and diastole thereby produced.

I also took a number of photographs of transverse sections of ventricles in diastole and in the strong systole obtained by heating the same heart. These are particularly instructive in showing the anatomical relations of the walls, papillary muscles, etc., and the uniform shape of the periphery of the narrowing ventricular cavity in its different stages of contraction. Other photographs which I have taken illustrate the movements of the heart which may take place after its rapid excision from the body, and also the fact that the right ventricle under certain conditions may keep on pulsating after the left has ceased.

The process of photographing the intestinal peristalsis was very similar to that employed for the heart, and the intestines were stimulated to movement by mechanical irritation, by applying drugs to the mesentery, etc. My efforts to photograph the contractions of the bladder and the movements of the diaphragm as seen from the abdominal cavity have been less successful, for I have done the work entirely alone. With proper assistance, muscular contractions of every sort could be easily permanently recorded by photography, and in experiments upon the heart artificial respiration should be maintained, while tracings of the pulse, blood pressure, etc., should be simultaneously recorded. Although the experiments which I have thus far been able to make with the action of drugs, are not in all cases of special scientific value, I have certainly demonstrated that it is possible and easy to photograph the complicated movements of the heart and intestines. The negatives (or positive glass slides easily made from them) can be enlarged with a stereopticon for class-room demonstration, and very many facts in regard to physiology and the therapeutic action of drugs can be most accurately and graphically recorded, and the photographs when studied at leisure reveal many interesting details which are easily overlooked at the time of operation. Moreover, it seems possible that with better apparatus

than the very limited facilities at my command afford, something of value may be added to our knowledge of the real nature of rhythmical peristaltic movement, at present so poorly understood. It is with the hope of stimulating such research, and also of illustrating and enlivening a great deal in Materia Medica that is perplexing for students, that I have undertaken this pioneer work in the instantaneous photography of the heart in motion, and of intestinal peristalsis.

The Records of the Virginia Company. By J. F. Jameson.

[Abstract of a paper read before the University Historical and Political Science Association, November 20, 1885].

Two manuscript copies of these records are in existence, and writers upon the subject have, in nearly every instance, confounded the two. It was the object of this account to reconstruct the true history of both, and to correct the errors made in regard to them by previous writers.

The original records of the Company are not known to be now extant. But during the last year of its existence copies of its records for the last five years, 1619–1624, were made. There are two accounts of the way in which these copies came to be made; one written about 1654 by John Ferrar, and printed in Dr. Peckard's life of Nicholas Ferrar, the other given in an anonymous and rare pamphlet by Arthur Woodnoth, published in 1651. Both describe the copies as having been made secretly, in apprehension of a seizure of the Company's papers by the King, and as having been subsequently given to the Earl of Southampton, its Treasurer, as furnishing means whereby he might defend his acts and those of his associates in case of prosecution. But while the latter declares the copies to have been made by the care of Sir John Danvers, at the instance of Secretary Collingwood, the former attributes this to the forethought of the Deputy Treasurer, Nicholas Ferrar. They are said to have passed from the custody of the Earl of Southampton to that of Sir R. Killigrew and then to that of Sir E. Sackville. But at the death of the Earl of Southampton's son, in 1667, they were bought by Dr. Wm. Byrd, of Virginia, and became a part of the library at Westover. They were used by Stith, who has left a description of them. From the Westover library they passed into the possession of Thomas Jefferson, in a way which he has described in a letter written in 1823. Between that date and 1830 they became a part of the Library of Congress, in which they still remain. The proofs of their identity, not only with the copy used by Stith, but also with that made by the members of the Company in 1623 and 1624, were described.

An account was then given of the history of the other manuscript, also in two volumes possessed at one time by John Randolph of Roanoke and afterward by the late Conway Robinson, Esq., and some conjectures were expressed as to the time and circumstances in which it was copied from the first. Some description of the third volume accompanying this set, and of an additional volume in the Library of Congress, was given. The conclusion of the account consisted of an exposition, too detailed to be here summarized, of the errors made in their references to these two manuscripts by the writers mentioning them, Burk, Hening, Howison, J. W. Thornton in the Historical Magazine, Campbell, Wm. Green in the Southern Literary Messenger, and Neill in his Virginia Company; especially of the curious ways in which the one manuscript has been confounded with the other, and of the difficulties which this has interposed in the way of the reconstruction of their true history.

Note on Isaeus. By E. H. Spieker.

[Abstract of a paper read before the University Philological Association, December 4, 1885].

In this paper a number of peculiarities of syntax in the speeches of Isaeus as found in the MSS. were considered, especially the omission of *ἀν* where the ordinary prose use requires its presence, and *vice versa* its use, where it would not ordinarily be found. The speeches of Isaeus were not studied at any period to such an extent or so carefully as those of the great orators, and so it is natural that errors of writing should not only have crept in but also been allowed to remain. Most of the cases can be readily explained as examples of ordinary errors in writing, and in most of the editions the necessary corrections have been made. The supposition that these mistakes really represent the language use of Isaeus, as is contended by Röder, is manifestly wrong.

On the Antiseptic Action of Acids. By J. R. Duggan.

[Abstract of a paper read before the University Scientific Association, January 6, 1886].

Although a great number of determinations of the antiseptic power of various substances have been made, they are applicable only to certain conditions; and do not hold good when these are changed from those under which the experiments were made. With a view towards studying the influence of the substances usually present in culture-fluids in increasing or retarding the antiseptic action of acids, the author has investigated the action of acids on cane sugar or starch, and on diastase. It was found that in general, the action of an acid in retarding the conversion of starch by diastase was proportional to the rate at which it inverted cane sugar, which, as Ostwald has shown, is a measure of its affinity. A few acids, however, act much more powerfully on diastase than on sugar, but this is due to a secondary action which may consist in reduction or oxidation, as with sulphurous or chromic acids; or there may be, especially in the case of acids from metallic oxides, a specific action similar to that shown by the salts of the corresponding metals. The neutral salts of acids that act in proportion to their affinity have very little influence on the conversion of starch by diastase when they are present in equivalent amounts, showing that the retarding influence of these acids is due simply to their acid properties; and therefore anything that tends to neutralize such an acid produces a corresponding diminution in its action on diastase. This may be accomplished, not only by the addition of a base, but by proteid matter or by neutral salts. Chittenden has recently shown that an excess of proteid matter prevents the retarding influence of acids on diastase, and may even cause an increase in the amount of starch converted. The author has also found that the presence of neutral salts affects the action of acids on diastase in the same manner that Spohr has shown them to influence the inversion of sugar. It is probable also that a change of temperature causes the same variation in the action of neutral salts in either case.

As bacteria cannot be cultivated except in the presence of these substances that interfere with acid action, it has not been possible to conduct a series of perfectly parallel experiments on the antiseptic action of acids, but such as have been made, and our general knowledge on this subject indicate that the majority of acids prevent the development of organisms simply by their acid properties, and that the remainder of the molecule has no effect, except of course, as it affects the affinity of the acid. It does not follow from this that acids act in ordinary culture-fluids exactly in the order of their affinities, since the salts and proteid matter present probably do not influence all acids to the same extent. Thus the solubility of the acid added would perhaps determine the extent to which it would replace the combined acids in the solution. This, and similar questions, cannot be decided until our knowledge of the reactions that take place between bodies in solution is more definite. In general, however, the antiseptic action of acids seems to be proportional to their affinity. For example, the coefficient of affinity of meta and para oxybenzoic acids is very low as compared to their isomer, salicylic; and the author has formerly shown (*Amer. Chem. Jour.* Vol. VII, No. 1.) that the proportion of these acids required to prevent the development of *Bacillus subtilis* is in the same order. In fact, all organic acids that are used as antiseptics, such as benzoic, phenylacetic, oxyphenylsulphonic, etc., possess a high coefficient of affinity; so that there is no reason to suppose that these acids act as "protoplasmic poisons," except as this may be said of all acids;—their greater action being due simply to their greater acidity, and perhaps to the fact that they are not neutralized to the same extent by the proteid matter and salts in the solution.

Since the affinity of an acid may be increased by the introduction of certain groups, it appears probable that before very long it will be possible to form some idea of the antiseptic value of an acid from its chemical constitution. For example, the experiments of Ostwald show that the groups (C_6H_5), (SO_2OH), and (OH) all seem to increase the affinity of acids when introduced into the molecule. The combination of these three groups is oxyphenylsulphonic acid which has of late come into considerable use as an antiseptic under the name of aseptol.

Similar experiments are being made on the influence of the alcohols on diastatic action. This is found to follow in the order of their physiological action; and may be used, it is hoped, to some extent, as a measure of the same.

Speech Mixture in French Canada: External Influences. By A. M. Elliott.

[Abstract of a paper read at a meeting of the University Philological Association, December 4, 1885].

Following up the general preliminary article on the French language in Canada, (see *American Journal of Philology, Vol. VI., p.* 135 *et seq.*), the writer points out here the special external influences,—political, religious and social,—that have been at work since the earliest settlements in New-France to produce the mingling of dialect varieties such as is found to-day with the French Canadians. It was necessary to consider these agencies before going on to the purely linguistic problems that grow out of a mixture of speech elements essentially different on the one hand, as in the case of the Indian and French or the English and French, or on the other hand, of varieties of language that have a natural relation within a definite circle of allied linguistic products as in the case of Langue d'Oïl and Langue d'Oc dialects or, more intimate still, of the Langue d'Oïl species with one another. Could we stop at the broad lines of demarcation, as indicated in the preliminary article referred to above, could we take into account the few linguistic varieties only that constituted the original speech compound, we should find it no very difficult task to trace the interlacing threads of these language forms and to note their reciprocal influences in the production of existing types, but the problem here is conditioned by incomparably greater difficulties. The individual dialects that were brought to these shores by the earliest settlers serve simply as so many definite points d'appui, as so many trusty landmarks in the labyrinth of a linguistic mixture that was the natural outgrowth of constant and promiscuous immigration for more than one hundred and fifty years. It is fortunate for the investigator that he has these fixed points in the field of his observation; otherwise much of his searching would be in vain and much of what he might think to be real discovery would be only conjecture with reference to the great mass of his many colored and perplexing material. We find at work in Canada all those agencies which produce speech mixture among languages where the types are more distinctive and where the relations of these types have settled into that special mould that marks the separation of language from dialect. Of course, the more intimate the relation between any two forms of speech, the more easy is the passage of the one to the other, provided they both belong to the same general stock and it is in this position, as we shall see when we come to particular speech varieties, which the set of dialects of the Province of Quebec holds with reference to those of the Maritime Provinces, that is, instead of being distinctly individual languages, they must be regarded as different phases of one general speech, but possessing at the same time characteristics sufficiently marked to individualize them and cause them to represent, for all working purposes, two distinct forms of language. We shall consider, therefore, this subject of speech mixture under the various headings that mark the natural mingling of linguistic forms such as the influence of the purely external circumstances of life and the influence of divergent linguistic products upon one another. It may easily happen in certain cases, that the second part of this problem is contained in or conditioned by the first; in truth, precisely here in Canada, we shall note how it is that peculiar circumstances of life have especially contributed to certain developments of speech that could never have existed had it not been for their concurrence at a given time in the political, social and religious experiences of the people. In fact, nowhere else, perhaps, have these cardinal functions of organic growth in civilized society acted more powerfully toward the production of a composite language. It is here, if anywhere, that we must carefully consider the reflex of the feudal system in language-making; it is here that the social and religious life, bound together into an indissoluble whole, have left their indelible stamp upon the speech from the humblest peasant who left France to act the part of pioneer of French civilization on the American Continent down to his peaceable, hard-working, frugal, self-sacrificing descendant of to-day, the habitant, who no longer rejoices in the patois of his ancestor but who has risen, without effort and unsuspectingly, to a higher plane in the scale of linguistic development.

The mere circumstance itself of bringing together emigrants for the New World from several of the Chief Departments of France, in an age where the means of communication among the different linguistic centres were slow and laborious, and when, consequently, the varieties of idiom were much more marked than we now have them,—this condition of things alone was sufficient to produce important changes in the language of inhabitants who, before this, had never come into any social relation with one another and where necessary contact and more or less intimate association after they had planted foot on American soil, afforded an opportunity to take the initial steps in that levelling of grammar forms and intermixture of phonetic elements which are found to-day in the French language of Canada.

One feature, moreover, of this mixed society must be borne in mind, as it will help to explain how the process of social amalgamation was carried forward with so universal success, namely, the superior character of the earliest settlers, the "rank and file" of whom were chosen from the more thrifty, prosperous class of the common folk, and thus were established favorable conditions for the immediate growth of a form of language more homogeneous than that which existed in the mother country, where the social elements were more diverse and consequently less congenial. And that not only a strong tendency to uniformity of speech actually did develop among these colonists, but also that the results of it were surprising, is manifest from the testimony of sundry writers previous to the conquest in 1760. In truth, some of them go so far as to maintain that better French was spoken on the banks of the St. Lawrence than in France itself, and account, in part, for this extraordinary state of things by the less mixed character of society and the large proportion of educated persons who had joined the expeditions to the American Continent. There was, also, no difficulty for the peasant in Canada to acquire a liberal means of subsistence after the Colony had once taken foothold there; his social status was greatly improved by his constant and intimate relations to those of his own class and his language bettered by the friendly and democratic conditions in which he lived with his lord.

The seigneurial tenure carried with it certain rights that must also be carefully noted, if we would understand this source of external influence on the language. Many privileges, the requirement of military service, etc., that the ruling class had enjoyed in France and which had grown to be obnoxious to the folk through improper extension and actual abuses, were lopped off when the feudal system was transferred to America, where, united with religion, it formed the dual basis of society. Through feudal custom, moreover, there were certain points of commercial interest in which the two classes of Canadian society, seigneurs and the peasants, were brought into friendly contact. The "droit de banalité," the obligation to keep their seigneuries cleared and occupied or have them revert to the crown at the expiration of one year, served to break up any tendency to exclusiveness on the part of the lord, and often gave the habitant a chance to place himself on an equality with him so far as this world's goods are concerned. But all of these social conditions and peculiar political relations put together must have been of little moment in reforming and ameliorating the various speech varieties of the Canadian folk compared with influences brought to bear upon them by the clergy, by the members, male and female, of those numerous church establishments, of the various corporations organized by private munificence, devoted to the instruction of the young and to the spreading and strengthening of the Catholic faith. Here the priest has such a grasp upon the confidence of the common people that his spiritual authority is unquestioned and his dicta seldom go unheeded. He is not a mere figure-head behind which society moves in devious routes and is shielded in its malpractices by the emblem of sanctimonious power, but a living presence whose force is always felt to be the most important, the most extensive and the most potent social factor in every community. To have so universal a hold on the sympathies of any people, these representatives of the church must have proved themselves not only worthy of their calling by their devotion, self-sacrifice and godly life, but they must necessarily have controlled the early education of their people. And this brings us to the last and most cogent force of a purely external nature that helped to abrade the dialect irregularities and reduce to a homogeneous state, the structure, forms and sounds of the Canadian language.

On Silent *t* in Modern English. By J. W. Bright.

[Abstract of a paper read before the University Philological Association, December 4, 1885].

An explanation for the disappearance of *t* from the pronunciation of such words as *often, soften, hasten, castle*, etc., was found in the physiological character of these particular *t*'s and in the nature of their environments. This communication was published in full in *Modern Language Notes*, vol. I, pp. 2–3.

The Earliest Municipal Code of Strassburg. By J. M. Vincent.

[Abstract of a paper read before the Seminary of History and Politics, February 5, 1886].

The laws which Strassburg received in its first code were the earliest known among the cities of Germany, as a body of written statutes. They date from sometime after A. D. 1050, but retain the monarchical spirit of a much earlier period. The city was under almost complete control of the Bishop. He appointed the chief officials, depending on no one for approval except the *familia ecclesiae*, and that only in the choice of the highest, the Advocate.

The Advocate was the chief representative of the Bishop in the administration of justice. As ecclesiastics were not allowed to judge over life and death, this official received in his stead the investiture of the sword from the king, and was the person through whom the power to judge of minor offences was passed on to the inferior officers. The Advocate's court was held in the Bishop's palace, and his perquisites were one-third the fines and compositions taken for breaches of peace in all the courts. His deputy executed the sentences of death or mutilation.

Second in importance stood the Causidicus, or Prefect, who was appointed by the Bishop with no restrictions, except the general rule, that no one except the Advocate could be appointed outside the *familia ecclesiae*. The Prefect was sole judge over larceny and minor breaches of the peace, and his jurisdiction extended over the whole population of the city and all who came in from the diocese, except ecclesiastics. He appointed the jailer and constables. At this time the whole police force consisted of this jailer and two bailiffs.

Next below the Prefect was the Burggraf, whose duties would now mostly belong to one branch of the police department, or the board of public works. He was responsible to no one except the Bishop, and received the authority to hold court from the Advocate. He appointed the masters of the Guilds, and kept general oversight of their management. He was inspector of buildings, streets, and part of the bridges, had charge of the walls and the moat and could inflict heavy fines for damages to the same. The erection of flour mills depended on the consent of the populace and the license of the Burggraf.

The Thelonearius, or Revenue Collector, was appointed by the Bishop also. Except certain tolls paid to the Burggraf and certain tithes directly made over to the Bishop he had all the taxes to collect. He inspected wet and dry measures. Scales and weights must come from the mint. Almost every transaction of business amounting to five *solidi* had to pay a tax. The ratio was one penny to every five *solidi*, or one pennyweight of silver out of every three ounces. There were numerous exemptions, however, in favor of ecclesiastics and their dependents.

The above officials held all that now would be strictly called municipal offices. There were other minor magistrates, but they were no more administrative than are justices of the peace. But the Bishop, like many other princes, had the right to coin money, and appointed a Master of the Mint. This officer had, in addition to the management of coinage, jurisdiction over counterfeiters throughout the diocese. The Bishop had the right to determine when currency should be called in and new issues made, with no restrictions, except that six weeks' notice must be given at intervals of a fortnight.

No mention is made of a city council or board of aldermen. The Bishops would be slow to divide their authority as long as the law expressly stated that no one should judge over the city except the Emperor, the Bishop and those whom the latter appointed. The citizens obtained the privilege of a council only after long struggles against vehement opposition of the Bishops.

The services required of the citizens by the Bishop were laid down in extended detail, especially for artisans. It is difficult to say upon what they are based. In determining this it should be remembered in the first place that dues and taxes in that time were most frequently paid in service, or in kind, and do not necessarily imply serfdom, although there doubtless were classes whose personal freedom was limited. Second, the Bishop stood in three relations to the people, (a) Ecclesiastical head of a diocese, (b) a Landlord over great estates upon which services were rendered as rent, (c) Governor of the city, for which he was entitled to support in protecting and governing. It may be that these distinctions were not very clear in the minds of the citizens, but they perhaps account for the multiplicity of dues which on the outside look almost like slavery. Whether it was an imposition to be compelled to work, even when paid for it, as some crafts were, depends on the pay and on the solvency of the paymaster, of which matters the law gives no hint. But we know that the citizens became very anxious to have a voice of their own in the government of the city, and gradually obtained it.

On Hebrew Words in the Codex Sangallensis 912. By Cyrus Adler.

[Abstract of a paper read before the University Philological Association, January 8, 1886].

In the introduction to his paper on Latin Glossaries, with especial reference to the Codex Sangallensis 912 (printed Vol. XV. of the *Transactions of the American Philological Association*, pp. 124-228), Dr. Minton Warren remarks (p. 126): "Most of the words are Latin. Not a few Hebrew words and proper names, however, occur, due to ecclesiastical sources." The latter part of this remark induced a study of the Hebrew words and names. Such collections may be valuable, as they certainly are interesting for etymology and pronunciation of both Hebrew and Latin (see for instance, Die Aussprache des Hebräischen bei Hieronymus von Carl Siegfried in the *Zeitschrift für die Alttestamentliche Wissenschaft*, 1884, pp. 34-83). There are about 60 Hebrew words and names, some of which are common enough, as for instance, *adonai-dominus* = אדני, etc.

Some others are not so evident; thus *aelam* = *porticum*. This is Hebrew אולם; written also אלם, a porch especially of the temple (cf. IK. 6: 3, 7: 6; Joel, II: 17; II Chr. 15: 8; אולם יהוה). Jerome transcribes these words in the same way (cf. Siegfried, p. 36).

A, 226. Alma: virgo sancta, Hebreum est; aalma: virgo. The note on these words is as follows: "'Neubauer says *aalma* is a mere repetition of the previous Hebrew word. The double *a* he thinks is introduced on account of the guttural sound of the *a*' (Ellis)." It seems much more likely however that the glosses are transposed; that aalma is for העלמה, with the article, and should be explained by virgo sancta, while alma is for עלמה and means virgo. The transcription of the article preceding an initial guttural by *aa* is not uncommon. Thus Jerome renders האדם by *aadam* and הֶחָנָב by *aagab* (see p. 36 of Siegfried's article).

B, 22. Babil-confusio. This of course follows the punning etymology in Genesis XI: 9. *Bab-ili* means "gate of God."

B, 47. Bartholomeus: filius sco pendentes aquas corrected in note to filius suspendentis aquas. This curious etymology was obtained by dividing the name up as follows: בר תל מי.

D, 11. Dabir-oraculum. This is of course דְּבִיר, one of the most sacred parts of the temple. Jerome gives the same transcription.

E, 14. Effeta: adaperire. This word must be referred to Mark, 7: 34: "And looking up to heaven he sighed and saith unto him, ἐφφαθά; that is, be opened." Jerome gives *ephphetha* and refers to this passage. Kautzsch (Grammatik des Biblisch-Aramäischen, Leipzig, 1884) (p. 10), explains this as an Ethpe'el form; *i. e.* for אֶתְפְּתַח.

H, 96. Hiersolima: visio pacis. This etymology presupposes the derivation of the first part of ירושלם from the stem ראה. The name Jerusalem occurs in Assyrian as *Ur-sa-li-im-mu*, and the *ur* may be the Akkadian word for city, found also in Ur Kasdim.

N, 10. Nablum: quod graece spalateriū. This is probably the Hebrew נבל, a musical instrument frequently mentioned in the Psalms.

R, 13. Rama: excelsa. This is a correct etymology of the Palestinian city, רמה.

S, 233. Sion: specula. This gloss furnishes a very good etymology for the name Zion. It evidently is the word ציון, found in plural in Jer. 31: 21, meaning mark. Jerome transcribes the form in Jeremiah *Sionim*, and it is accordingly not impossible that this word and the name Zion are identical —so that we may infer either that ציון is an incorrect vocalization, or else the difference in the vowel is to be explained as the result of dialectical influence.

Note on Partitions. By D. Barcroft.

[Abstract of a paper read at a meeting of the University Mathematical Society, January 20, 1886].

If we represent by $(w:i,j)$ the partitions of w into j parts, none greater than i, then,

$$(w:i,j)=(w-j:i-1,j)+(w:i,j-1). \quad (1)$$

In particular when $i=w$,

$$(w:w,j)=(w-j:w-1,j)+(w:w,j-1)$$

which may be written

$$(w)_j=(w-j)_j+(w)_{j-1},$$

and, since $(w:i,j)=(w:j,i)$, we have also

$$(w)_i=(w-i)_i+(w)_{i-1}.$$

From (1), by making $j=w-k$, we get

$$(w:i,w-k-1)=(w:i,w-k)-(0:i-1,w),$$

which, by repeated application of (1), gives

$$(w:i,w-k-1)=(w:i,w)-\sum_0^k k\,(k:i-1,w-k).$$

If $k \leqq \frac{w}{2}$

$$(w:i,w-k-1)=(w)_i-\sum_0^k k\,(k)_{i-1}. \quad (2)$$

If k is greater than $\frac{w}{2}$, say $k=\frac{w}{2}+a$, then, w being even,

$$(w:i,\tfrac{w}{2}-a-1)=(w)_i-\sum_0^{\frac{w}{2}+a}k\,(k)_{i-1}+a\,[(0)_{i-2}+(1)_{i-2}]+(a-1)$$
$$[(2)_{i-2}+(3)_{i-2}]+\ldots+(2a-2)_{i-2}+(2a-1)_{i-2} \quad (3)$$

where $a \leqq \frac{w+4}{6}$; similarly,

$$(w+1:i,\tfrac{w}{2}-a)=(w+1)_i-\sum_0^{\frac{w}{2}+a}k\,(k)_{i-1}+a\,(0)_{i-2}+(a-1)$$
$$[(1)_{i-2}+(2)_{i-2}]+(a-2)\,[(3)_{i-2}+(4)_{i-2}]+\ldots(2a-3)_{i-2}$$
$$+(2a-2)_{i-2}, \quad (4)$$

in which $a \leqq \frac{w+8}{6}$.

Formulas (2), (3), (4), enable us to determine, in most cases $(w:i,j)$ from a table giving $(w)_i$. The terms, other than those of the form $(w)_i$, can also be tabulated, thus making the calculation still easier. Thus, if we write

$$\sum_0^k k)_i=S_{k,i},\ a\,[(0)_i+(1)_i]+(a-1)\,[(2)_i+(3)_i]+\&c.=A_{a,i}$$

and $a\,(0)_i+(a-1)\,[(1)_i+(2)_i]+(a-2)\,[(3)_i+(4)_i]+\&c.=A'_{a,i}$

formulas (2), (3) and (4) become

$$(w:i,w-k-1)=(w)_i-S_{k,i-1}$$

$$(w:i,\frac{w}{2}-a-1)=(w)_i-S_{\frac{w}{2}+a,i-1}+A_{a,i-2}$$

$$(w+1:i,\frac{w}{2}-a)=(w+1)_i-S_{\frac{w}{2}+a,i-1}+A'_{a,i-2}.$$

$S_{k,i}$, $A_{a,i}$ A'_a can be calculated from the formulas

$$S_{k+1,i}=S_{k,i}+(k+1)_i$$
$$A_{a+1,i}=A_{a,i}+S_{2a+1,i}$$
$$A'_{a+1,i}=A'_{a,i}+S_{2a,i}$$

What has been said regarding the calculation of $(w:i,j)$ applies word for word to $\Delta(w:i,j)$, for we have

$$\Delta(w:i,j)=\Delta(w-j:i-1,j)+\Delta(w:i,j-1)$$

and

$$\Delta(w)_i=\Delta(w-i)_i+\Delta(w)_{i-1};$$

the meaning of $\Delta(w:i,j)$ being $(w:i,j)-(w-1:i,j)$ and that of $\Delta(w)_i$, $(w)_i-(w-1)_i$.

Examples.

$(25:8,7)=(25:7,8)=(25)_7-S_{16,6}+A'_{4,5}=860-634+46=272.$
$(24:8,7)=(24:7,8)=(24)_7-S_{15,6}+A_{3,5}=733-498+28=263.$
$\Delta(25:8,7)=\Delta(25:7,8)=\Delta(25)_7-\Delta S_{16,6}+\Delta A'_{4,5}=127-136+18=9.$

Formulas (3) and (4) include the rule given by Mr. G. S. Ely in *University Circular*, No. 15, May, 1882.

Die Finanzpolitik im Nordamerikanischen Bürgerkrieg. By Dr. Arthur Yager. (An essay published in the Zeitschrift für die gesammte Staatswissenschaft. Tübingen, 1886).

This paper, written by Dr. Arthur Yager while a student at the Johns Hopkins University, presents a condensed but careful account of the financial policy of the United States government during the late Civil War. It is based on an extensive study of original documents.

PROCEEDINGS OF SOCIETIES.

Scientific Association.

February 3.—Sixty-ninth regular meeting. Professor Remsen in the chair. Forty members present.

Papers read:
Instantaneous Photographs of the Heart in Motion and of Intestinal Peristalsis, by W. G. Thompson. (*Abstract on p.* 60).
On the Distribution of Lines in the Spectra of various Substances, by H. A. Rowland.

March 3.—Seventieth regular meeting. Professor Remsen in the chair. Thirty members present.

Papers read:
Malarial Germ of Lavaran, by G. M. Sternberg.
The New Element of the Blood, and its Relation to Coagulation, by G. T. Kemp.
The Manufacture of Aluminium, by W. R. Orndorff.

Philological Association.

February 5.—Sixty-seventh regular meeting. Professor Gildersleeve in the chair. Thirty-one members present.

Papers read:
On the Participle in Pindar, by C. W. E. Miller.
On Gilic as Adverb in Old Saxon and related forms, and on the Relation of the forms Grornôn and Gornôn in Old Saxon, by H. Wood.

March 5.—Sixty-eighth regular meeting. Professor Gildersleeve in the chair. Thirty-five members present.

Paper read:
The Origin and Settlement of the Pennsylvania Germans, by M. D. Learned.

Historical and Political Science Association.

January meetings.—Dr. H. B. Adams in the chair.

Papers read:
The Presidential Office, by R. D. Mussey.
The Organization of the Public Domain of the United States, by S. Sato.
The Bluntschli Manuscripts, by J. M. Vincent. (*Abstract on p.* 59).
Introduction to a Study of Land Grants for Roads and Canals, by A. N. Bliss.
Institutional Lessons of the newly discovered Cretan Code, by Herbert Smyth.

February meetings.—Dr. H. B. Adams in the chair.

The Earliest Municipal Code of Strasburg, by J. M. Vincent. (*Abstract on p.* 63).
The Study of History at Columbia College, 1774–1865, by H. B. Adams.
Germs of the American Constitution, by A. N. Bliss.

Mathematical Society.

January 20.—Professor Newcomb in the chair. Eleven members present.

Papers read:
Note on Partitions, by D. Barcroft. (*Abstract on p.* 64).
New Proof of Theorem, "Every Equation has a Root," by J. C. Fields.

February 23.—Dr. Story in the chair. Nine members present.

Papers read:
A Note on Unicursal Curves, by W. E. Story.
A Proof of Elliptic Function Addition Theorem, by J. C. Fields.

Archæological Society.

December 16.—Seventh general meeting. President Gilman in the chair. Forty-eight members present.

The Methods of Archæological Research, by Professor F. W. Putnam, of the Peabody Museum, Cambridge, Mass.
Attention was drawn to the want of scientific method in archæological investigations made in our country and to the advantages of the thorough system of excavation practised by Professor Putnam himself in his work in the Ohio Valley, the results of which were exhibited in detail.
The Importance of the Gortyna Code for Greek law, by H. W. Smyth.
This is the longest document we possess for the study of Greek law, as well as the earliest, as it probably dates back to time of Solon (see Professor Merriam's paper in *American Journal of Archæology*, October, 1885).

January 13.—Eighth general meeting. Professor Gildersleeve in the chair. About one hundred and fifty persons present.

The Greek Sculpture in the Museums of Athens, by Russell Sturgis of New York.
Athens is one general museum of sculpture, much of which is but little known. The most important works were illustrated by slides, especially the sepulchral monuments of the IV century B. C., many of them probably executed by the followers of the Pheidian School.
Recent Changes and Archæological Discoveries in Rome, by A. L. Frothingham, Jr.
The building of the new quarters has brought to light, especially during the last two years, works of art of most unusual interest, from the archaic necropolis at least contemporary with the usual date for the foundation of Rome, to numerous works of the early Empire—mausoleums, bronze statues, rostra, atrium of the vestals, etc.
The French Expedition to Susa and recent Archæological Discoveries in Persia, by M. E. Babelon of Paris.
Abstract of a paper sent for publication to the *American Journal of Archæology*.

DEATH OF PROFESSOR CHARLES D. MORRIS.

OBITUARY NOTICE.

Professor Charles D'Urban Morris, Collegiate Professor of Latin and Greek in the Johns Hopkins University, died at his residence in Baltimore, February 7, 1886, after an illness of nearly ten days.

He was a son of Rear-Admiral Henry Gage Morris, of the British Navy, who came of a Yorkshire family, was born in New York in 1770, and married in 1807, a daughter of the Rev. F. Orpen, a clergyman of the English church in the county of Cork. Professor Morris, who was one of a family of ten children, was born in Charmouth, Dorset, England, February 17, 1827. He received his collegiate training in the University of Oxford. As a student of Lincoln College he was admitted to the degree of Bachelor of Arts in 1849. His name appears in the first class of those who received honors *in literis humanioribus*. Three years later he became a Master of Arts and a Fellow of Oriel College. He came to this country in 1853, and was for a time Rector of Trinity School in the city of New York, and subsequently master of a private school for boys at Lake Mohegan, near Peekskill. He was then made a Professor in the University of the City of New York, and from that position he was called in 1876 to the chair in the Johns Hopkins University, which he held until his death.

He was the author of a Latin Grammar and Reader, and of an Attic Greek Grammar, in which some original views of the proper methods of teaching the elements of the Latin and Greek languages were carefully unfolded; and he wrote a number of articles on philological topics, most of them contributed to the American Journal of Philology and to the American Philological Association. At the time of his death, he was nearly ready to publish an edition of the first book of Thucydides, with notes, the final sheets of which will be carried through the press by his associates.

His powers however were chiefly devoted to the work of instruction and he never appeared to greater advantage than when surrounded by his pupils in the class room or in his parlor, or when he took part in the admission of undergraduate students and in the presentation of candidates for the baccalaureate degree. His enthusiasm, his sympathy, his honesty and his Christian faith were apparent under all circumstances; and there was a personal charm in that mixture of confidence and diffidence which he so often manifested,—confidence in the domain with which he was familiar, diffidence with respect to duties which he was not accustomed to perform. The University will long lament his death.

The body of Mr. Morris was buried in St. Paul's churchyard (corner of Fremont and German sts.) on Wednesday, February 10. The funeral services, conducted by Rev. Dr. J. S. B. Hodges, the Rector, were held in St. Paul's church. The officers and students of the University accompanied the family as mourners from the dwelling house to the church.

Resolutions of Respect.

On the day of the funeral the officers and students of the Johns Hopkins University assembled in Hopkins Hall, and after a few introductory words from President Gilman, the following resolutions were presented by Professor Gildersleeve, in a brief address, and after additional remarks by Professor Warren, by Messrs. R. W. Rogers, and Allan C. Woods,—two of Mr. Morris's recent pupils,—were unanimously adopted.

Resolved, That we as members of the Johns Hopkins University herewith give public expression to our respect for the memory of the late Professor Morris and to our sorrow for the loss of one who occupied so important a position in our academic body as scholar, teacher, and man.

As a scholar, to the best characteristics of the English school in which he was trained, to refined taste, sound sense, exemplary accuracy, Mr. Morris united the most cordial sympathy with the new philological life of our day, the most eager receptivity of fresh truth from every source, so that his work never lost the glow of recent acquisition, never lacked the balance of thoughtful criticism.

As a teacher, he carried into the class-room the strength and the warmth of thorough conviction. Enthusiastic devotion to his subject, confidence in his methods, an ardent desire to impress and to impart, gave him a hold on his pupils that is given to few, and his instruction will ever be memorable to those who had the privilege of his inspiration and guidance.

As a man, Mr. Morris bore through life the stamp of a high and noble nature. Impetuous and frank, he was open alike in praise and blame. No man more scornful of the mean, none more generous in his appreciation of the good, and his influence and his example made for all that is best and truest. Loving as he did the society of young men, and sympathizing as few sympathize with their struggles and their aspirations, he was not content with the good he could do in casual intercourse, but delighted to gather about him under his own roof the members of the university, who in their turn honored and loved him as a father, as an elder brother. In the discharge of all his duties Mr. Morris was under the dominion of a strong religious sense. He lived as seeing Him who is invisible and under His eye gave himself with singleness of heart to the work which had been appointed him and continued faithful in it even to the end.

Resolved, That the foregoing resolution be communicated to his widow and to the members of his family in England and that the Trustees of the University be requested to enter the same upon their records.

The Matriculate Society of the University, and the Hopkins "House of Commons" held special meetings, previous to the funeral of Professor Morris, and adopted resolutions which expressed the sorrow which they felt at his death, their great respect for his scholarship and character, and their attachment to him as a teacher and friend.

ENUMERATION OF CLASSES, SECOND HALF-YEAR, 1885-86.

Mathematics. (49 Students).

Classes meet in Rooms 8, 14, and 16.

Practical and Theoretical Astronomy: PROFESSOR NEWCOMB. Twice weekly, Tuesday and Thursday, 9 a. m. (7).

Barcroft.	Campbell, G. M.	Haight.	Van Vleck.
Bell, L.	Fields.	Nixon.	

Mathematical Seminary: *Astronomy:* PROFESSOR NEWCOMB. Weekly, Wednesday, 3 p. m. (5).

Barcroft.	Campbell, G. M.	Fields.	Van Vleck.
Bell, L.			

Mathematical Seminary: DR. STORY. Weekly, Thursday, 5 p. m. (4).

Barcroft.	Fields.	Haight.	Nixon.

Introductory Course for Graduates: DR. STORY. Daily, 11 a. m. (6).

Ames.	Eichelberger.	Rich.	Van Vleck.
Campbell, G. M.	Gorton.		

Theory of Probabilities: DR. STORY. Twice weekly, Tuesday and Thursday, 12 m. (5).

Ames.	Campbell, G. M.	Fields.	Haight.
Barcroft.			

Advanced Analytic Geometry: DR. STORY. Three times weekly, Monday, Wednesday, and Friday, 1 p. m. (4).

Barcroft.	Fields.	Haight.	Nixon.

Conic Sections: (*Minor Course*): DR. STORY. Twice weekly, Tuesday and Thursday, 1 p. m. (15).

Ballard.	Eareckson.	Molinard.	White.
Brigham.	Ensey.	Motora.	Wiegand.
Browne, A. L.	Jones, W.	Roberts, D. E.	Wingert.
Dashiell.	Miller, W. H.	Taylor, F. W.	

Mathematical Seminary: DR. CRAIG. Weekly, Monday, 9 a.m. (4).

Barcroft.	Fields.	Haight.	Nixon.

Etasticity: (*Lamé*): DR. CRAIG. Three times weekly, Monday, Wednesday, and Friday, 1 p. m. (4).

Blandin.	Crew.	Keilholtz.	Van Vleck.

Differential Equations: (*Boole*): *Major Course:* DR. CRAIG. Twice weekly, Tuesday and Thursday, 11 a. m. (9).

Blandin.	Duffy.	Jayne.	McPherson.
Child.	English.	Keilholtz.	Weech.
Crew.			

Linear Differential Equations: (*Fuchs*): DR. CRAIG. Twice weekly, Tuesday and Thursday, 10 a. m. (4).

Barcroft.	Fields.	Haight.	Nixon.

Elliptic and Abelian Functions: (*Cayley, Clebsch, and Gordan*): DR. CRAIG. Three times weekly, Monday, Wednesday, and Friday, 10 a. m. (4).

Barcroft.	Fields.	Haight.	Nixon.

Problems in Mechanics: DR. FRANKLIN. Twice weekly, Monday and Friday, 5 p. m. (4).

Ames.	Barcroft.	Child.	Jayne.

Solid Analytic Geometry: (*Todhunter*): DR. FRANKLIN. Three times weekly, Monday, Wednesday, and Friday, 11 a. m. (5).

Duffy.	Laessig.	McPherson.	Weech.
English.			

Differential and Integral Calculus: DR. FRANKLIN. Three times weekly, Monday, Wednesday, and Friday, 1 p. m. (14).

Ballard.	Eareckson.	Miller, W. H.	Stevens.
Brigham.	Ensey.	Motora.	Taylor, F. W.
Browne, A. L.	Hoffmann.	Roberts, D. E.	White.
Dashiell.	Jones, W.		

Analytic Geometry (*Elementary*): DR. FRANKLIN. Three times weekly, Monday, Wednesday, and Friday, 4 p. m. (10).

Carey.	Jones, H. C.	Moore, G. W.	Rosenthal.
Hahn.	Loch.	Reader.	Warren.
Hilles.	Mann.		

Physics. (52 Students).

Classes meet in Rooms 3, 4, 7, and 8.

Mathematical Theory of Light: PROFESSOR ROWLAND. Daily, 10 a. m. (10).

Bell, L.	Crew.	Jayne.	Mansfield.
Blandin.	Eichelberger.	Keilholtz.	Morrill.
Child.	Gorton.		

Major Course: DR. KIMBALL. Daily, 12 m. (15).

Child.	Hobbs.	Nixon.	Stevens.
Dohme.	Holmes.	Randall, W. W.	Wiegand.
Emerson, W. H.	Jayne.	Rich.	Wingert.
Hedrick.	Laessig.	Scott.	

General Physics: DR. KIMBALL. Daily, 10 a. m. (22).

Bevan.	Fearn.	Hughes.	Merlwether.
Bolgiano.	Gilpin.	Jones, H. C.	Molinard.
Cradock.	Guggenheimer.	Lanier.	Moore, G. N.
Dorr.	Harry.	Macauley.	Simon.
Duffy.	Hodges.	Mann.	Weech.
Eareckson.	Hough.		

Laboratory Work:

Advanced Students: PROFESSOR ROWLAND. (8).

Ames.	Blandin.	Crew.	Keilholtz.
Bell, L.	Child.	Jayne.	Murrill.

Major Course: DR. KIMBALL. (14).

Dohme.	Holmes.	Scott.	Williams, L. E.
Emerson, W. H.	Laessig.	Stevens.	Wingert.
Hedrick.	Randall, W. W.	Wiegand.	Woodhull.
Hobbs.	Rich.		

Class in General Physics: DR. KIMBALL and DR. PERKINS. (24).

Allen, P.	Eareckson.	Hodges.	Mann.
Bevan.	Fearn.	Hough.	Merlwether.
Bolgiano.	Flexner.	Hughes.	Molinard.
Cradock.	Gilpin.	Jones, H. C.	Moore, G. N.
Dorr.	Guggenheimer.	Lanier.	Simon.
Duffy.	Harry.	Macauley.	Weech.

Chemistry. (88 Students).

Classes meet in the Chemical Laboratory.

Chemistry of the Carbon Compounds: PROFESSOR REMSEN. Twice weekly, Monday and Tuesday, 9 a. m. (37).

Applegarth, E. C.	Hartogensis.	McIntosh.	Roberts, D. E.
Brackett, R. N.	Hayes.	Mindeleff.	Smith, W. F.
Bucherer.	Hedrick.	Mount.	Stein.
Buckler.	Hemmeter.	Palmer, C. S.	Swartz.
Canfield.	Hobbs.	Penniman.	Turner.
Coar.	Holmes.	Piggot.	Wallis.
Dohme.	Kemp.	Pope.	Williams, J. W.
Friedenwald.	Laessig.	Randall, W. W.	Winslow.
Gooch.	Linn.	Rich.	Woodhull.
Hamilton.			

General Chemistry: PROFESSOR REMSEN. Lectures three times weekly, Wednesday, Thursday, and Friday, 9 a. m. (48).

Allen, P.	Dreyer.	Hamilton.	O'Donovan.
Ames.	Eareckson.	Hartogensis.	Palmer, C. S.
Boyd.	Eichelberger.	Henderson.	Pope.
Brill.	Engle.	Hodge.	Reese.
Bromwell.	English.	Jayne.	Reeve.
Bucherer.	Fearn.	Jones, H. C.	Shemwell.
Chisolm.	Fifield.	Kellholtz.	Simon.
Coates.	Forrest.	Lamb.	Stevens.
Crew.	Gieske.	Mann.	Stow.
Dashiell.	Gilpin.	Mason.	Strauss.
Dorr.	Gooch.	Molinard.	Williams, L. E.
Doub.	Gorton.	Moore, G. N.	Willis.

Laboratory Methods and Theoretical Chemistry: DR. MORSE. Twice weekly, Thursday and Friday, 9 a. m. (25).

Applegarth, E. C.	Hedrick.	Mount.	Swartz.
Buckler.	Hemmeter.	Penniman.	Turner.
Coar.	Hobbs.	Randall, W. W.	Wallis.
Dohme.	Holmes.	Rich.	Williams, J. W.
Friedenwald.	Linn.	Smith, W. F.	Winslow.
Hartogensis.	McIntosh.	Stein.	Woodhull.
Hayes.			

Laboratory Work: PROFESSOR REMSEN, DR. MORSE, and DR. RENOUF. (82).

Allen, P.	Dreyer.	Hobbs.	Piggot.
Ames.	Duggan.	Hodge.	Pope.
Applegarth, E.C.	Eareckson.	Hoen.	Randall, W. W.
Bayley.	Eichelberger.	Holmes.	Reese.
Bell, C. J.	Emerson, W. H.	Jones, H. C.	Reeve.
Bell, L.	Engle.	Kastle.	Schneider.
Boyd.	English.	Kellholtz.	Shemwell.
Brackett, R. N.	Fearn.	Kemp.	Simon.
Brill.	Fifield.	Lamb.	Smith, W. F.
Bromwell.	Forrest.	Linn.	Stein.
Bucherer.	Friedenwald.	Mann.	Stevens.
Buckler.	Gieske.	Mason.	Stow.
Canfield.	Gilpin.	McIntosh.	Strauss.
Chisolm.	Gooch.	Mindeleff.	Turner.
Coar.	Gorton.	Molinard.	Wallis.
Coates.	Hamilton.	Moore, G. N.	Williams, J. W.
Crew.	Hartogensis.	O'Donovan.	Williams, L. E.
Dashiell.	Hayes.	Orndorff.	Willis.
Dohme.	Hedrick.	Palmer, C. S.	Winslow.
Dorr.	Hemmeter.	Penniman.	Woodhull.
Doub.	Henderson.		

Mineralogy and Petrography. DR. WILLIAMS. (56 Students).

Mineralogy: (*Advanced*). Lectures three times weekly, Wednesday, Thursday, and Friday, 11 a. m. Saturday, 9 a. m.–12 m., Quiz and Practicum. (23).

Bayley.	Hamilton.	Lawson.	Randall, W. W.
Brackett, R. N.	Hayes.	Liebig.	Rich.
Brill.	Hedrick.	Linn.	Turner.
Coar.	Hoen.	Nason.	Williams, L. E.
Dehme.	Hobbs.	Orndorff.	Woodhull.
Engle.	Holmes.	Penniman.	

Mineralogy: (*Elementary*). DR. WILLIAMS. Weekly, Monday, 9 a. m. (32).

Allen, P.	Doub.	Gilpin.	Reese.
Ames.	Dreyer.	Gorton.	Shemwell.
Boyd.	Eareckson.	Henderson.	Simon.
Bromwell.	Eichelberger.	Jones, H. C.	Stevens.
Chiselm.	English.	Lamb.	Stow.
Coates.	Fearn.	Mann.	Strauss.
Dashiell.	Fifield.	Moore, G. N.	Willis.
Derr.	Forrest.	O'Donovan.	Woods.

Laboratory Work: DR. WILLIAMS. (8).

Bayley.	Hayes.	Lawson.	Orndorff.
Coar.	Hobbs.	Nason.	Palmer, C. S.

Biology. (48 Students).

Classes meet in the Biological Laboratory.

General Biology: PROFESSOR MARTIN. Three times weekly, Monday, Wednesday, and Friday, 10 a. m. (20).

Applegarth, E. C.	Hemmeter.	Pope.	Smith, A. D.
Coates.	Hodge.	Reese.	Stow.
Dreyer.	Lamb.	Reeve.	Straus.
Friedenwald.	Nuttall.	Rich.	Swartz.
Gooch.	O'Donovan.	Shemwell.	Willis.

Animal Physiology and Histology: PROFESSOR MARTIN. Three times weekly, Tuesday, Wednesday, and Thursday, 11 a. m. (14).

Buckler.	Kastle.	Price.	Wightman, A. C.
Hartogensis.	Kemp.	Smith, W. F.	Williams, J. W.
Hemmeter.	McIntosh.	Stein.	Winslow.
Herrick.	Nuttall.		

Laboratory Work: PROFESSOR MARTIN, DR. BROOKS, DR. HOWELL, and DR. MCMURRICH. Daily, 9 a. m. to 5 p. m. (44).

Abbott.	Friedenwald.	McIntosh.	Smith, W. F.
Andrews.	Gooch.	Miller, C. O.	Stein.
Applegarth, E. C.	Haldeman.	Nelson.	Sternberg.
Bruce.	Hartogenais.	Nuttall.	Stow.
Buckler.	Hemmeter.	O'Donovan.	Straus.
Campbell, J. P.	Herrick.	Orr.	Swartz.
Chandlee.	Hodge.	Pope.	Wightman, A. C.
Coates.	Jastrow.	Reese.	Williams, J. W.
Donaldson, F.	Kastle.	Reeve.	Willis.
Dreyer.	Kemp.	Shemwell.	Wilson.
Duggan.	Lamb.	Smith, A. D.	Winslow.

History of Morphology: DR. BROOKS. Three times weekly, Monday, Wednesday, and Friday, 9 a. m. (10).

Andrews.	Hemmeter.	McMurrich.	Orr.
Bruce.	Herrick.	Nelson.	Wilson.
Haldeman.	Kemp.		

General Zoology: DR. BROOKS. Twice weekly, Monday and Friday, 11 a. m. to 1 p. m. (13).

Andrews.	Kastle.	Nuttall.	Wightman, A. C.
Buckler.	McIntosh.	Smith, W. F.	Williams, J. W.
Hartogensis.	Nelson.	Stein.	Winslow.
Hemmeter.			

Physiology of Respiration: DR. HOWELL. Weekly, Monday, 12 m. (8).

Campbell, J. P.	Haldeman.	Herrick.	Nelson.
Donaldson.	Hemmeter.	Kemp.	Nuttall.

Osteology: DR. MCMURRICH. Twice weekly, Tuesday and Thursday, 10 a. m. (17).

Applegarth, E. C.	Hodge.	Reese.	Stow.
Coates.	Lamb.	Reeve.	Straus.
Dreyer.	O'Donovan.	Shemwell.	Swartz.
Friedenwald.	Pope.	Smith, A. D.	Willis.
Gooch.			

Greek. (40 Students).

Classes meet in 181 N. Howard St.

Greek Seminary: (*Plato*): PROFESSOR GILDERSLEEVE. Twice weekly, Monday and Wednesday, 10 a. m. (22).

Christie.	Hulzinga.	Patrick.	Smith, K. W.
Doubleday.	Hussey.	Peirson.	Steele.
Elliott, E. S.	Lodge.	Ramsay.	Stetson.
Elmer.	Magoun.	Scribner.	Trueman.
Fossum.	Milroy.	Slaughter.	Walz.
Harding.	Murray, A. T.		

Greek Syntax: (*Hypotactic Sentence in Greek*): PROFESSOR GILDERSLEEVE. Twice weekly, Tuesday and Thursday, 10 a. m. (25).

Christie.	Hulzinga.	Murray, A. T.	Slaughter.
Doubleday.	Hussey.	Patrick.	Smith, K. W.
Elliott, E. S.	Lodge.	Peirson.	Steele.
Elmer.	Magoun.	Ramsay.	Stetson.
Fossum.	Milroy.	Scribner.	Trueman.
Grier.	Moore, J. L.	Shefloe.	Walz.
Harding.			

Greek Philosophic Literature: (*Lectures and Readings*): PROFESSOR GILDERSLEEVE. Weekly, Friday, 10 a. m. (22).

Christie.	Hussey.	Patrick.	Smith, K. W.
Doubleday.	Lodge.	Peirson.	Steele.
Elliott, E. S.	Magoun.	Ramsay.	Stetson.
Elmer.	Milroy.	Scribner.	Trueman.
Fossum.	Moore, J. L.	Slaughter.	Walz.
Hulzinga.	Murray, A. T.		

Sophocles: *Antigone:* MR. CHRISTIE. Four times weekly, Tuesday, Wednesday, Thursday, and Friday, 12 m. (9).

Bruyn.	Grier.	McLane, R. M.	Rogers.
Cole.	Hoffmann.	Ness.	Thompson.
Flexner.			

Homer: *Iliad ix, xi:* ***Euripides:*** *Alcestis:* DR. SPIEKER. Four times weekly, Tuesday, Wednesday, Thursday, and Friday, 11 a. m. (8).

Bechtel.	Gildersleeve, R. C.	Loeb.	Palmer, O. H.
Devries.	Helfenstein.	Ness.	Rosenthal.

Prose Composition:

Class A: MR. CHRISTIE. Weekly, Monday, 12 m. (9).

Bruyn.	Grier.	McLane, R. M.	Rogers.
Cole.	Hoffmann.	Ness.	Thompson.
Flexner.			

Class B: DR. SPIEKER. Weekly, Monday, 11 a. m. (7).

Bechtel.	Gildersleeve, R. C.	Loeb.	Rosenthal.
Devries.	Helfenstein.	Palmer, O. H.	

Greek Dialects and Inscriptions: DR SMYTH. Weekly, Thursday, 12 m. (8).

Elliott, E. S.	Magoun.	Scribner.	Trueman.
Hussey.	Murray, A. T.	Steele.	Walz.

Latin. (70 Students).

Classes meet in 181 N. Howard St.

Seminary: (*Livy and Tacitus*): DR. WARREN. Twice weekly, Tuesday and Friday, 11 a. m. (25).

Bowen.	Hammond.	Moore, J. L.	Slaughter.
Christie.	Harding.	Murray, A. T.	Smith, K. W.
Doubleday.	Hussey.	Ness.	Steele.
Elliott, E. S.	Jones, C. E.	Peirson.	Stetson.
Elmer.	Magoun.	Scribner.	Trueman.
Fontaine.	Milroy.	Shefloe.	Walz.
Fossum.			

Latin Grammar: (*Lectures*): DR. WARREN. Weekly, Thursday, 11 a. m. (22).

Christie.	Hammond.	Magoun.	Slaughter.
Doubleday.	Harding.	Milroy.	Smith, K. W.
Elliott, E. S.	Harry.	Murray, A. T.	Steele.
Elmer.	Hodges.	Scribner.	Stetson.
Flexner.	Hough.	Shefloe.	Trueman.
Fossum.	Hussey.		

Practical Exercises: DR. WARREN. Weekly, Monday, 11 a. m. (18).

Elliott, E. S.	Hussey.	Ness.	Smith, K. W.
Elmer.	Magoun.	Peirson.	Steele.
Fontaine.	Milroy.	Scribner.	Trueman.
Fossum.	Moore, J. L.	Shefloe.	Walz.
Harding.	Murray, A. T.		

Pliny and Juvenal: DR. WARREN. Three times weekly, Tuesday, Thursday, and Friday, 10 a. m. (6).

Cole.	McLane, R. M.	Preston.	Thompson.
Flexner.	McPherson.		

Reading at Sight: DR. WARREN. Weekly, Wednesday, 10 a. m. (6).

Cole.	McLane, R. M.	Preston.	Thompson.
Flexner.	McPherson.		

Tacitus: MR. MOORE. Four times weekly, Tuesday, Wednesday, Thursday, and Friday, 10 a. m. (12).

Bayard.	Daish.	Hilles.	Rogers.
Black.	Gordon.	Hoffmann.	Willoughby, W. F.
Bruyn.	Hahn.	Reader.	Willoughby, W. W.

Horace: *Select Odes, Satires, and Epistles:* DR. SPIEKER. Four times weekly, Tuesday, Wednesday, Thursday, and Friday, 9 a. m. (11).

Bechtel.	Gildersleeve, R. C.	Palmer, O. H.	Tarleton.
Brown, H. M.	Helfenstein.	Poullain.	Taylor, R. T.
Devries.	Loeb.	Rosenthal.	

Prose Composition:

Class A: DR. WARREN. Weekly, Monday, 10 a. m. (6).

Cole.	McLane, R. M.	Preston.	Thompson.
Flexner.	McPherson.		

Class B: Mr. Moore. Weekly, Monday, 10 a. m. (3).

Bruyn. Hoffmann. Rogers.

Class C: Dr. Spieker. Weekly, Monday, 9 a. m. (11).

Bechtel. Gildersleeve, R. C. Palmer, O. H. Tarleton.
Brown, H. M. Helfenstein. Poullain. Taylor, R. T.
Devries. Loeb. Rosenthal.

Supplementary Class: Mr. Slaughter. Three times weekly, Monday, Wednesday, and Friday, 4 p. m. (12).

Bolgiano. Cradock. Duvall. Patterson.
Boyd. Dorr. Fearn. Reeves.
Chisolm. Dorsey. Lanier. Stow.

Shemitic Languages. Professor Haupt. (15 Students).

Classes meet in 111 W. Monument St.

Elementary Hebrew: (*Gesenius–Mitchell's Grammar; Genesis, ed. Baer*). Three times weekly, Tuesday, 1 p. m., Thursday and Friday, 4 p. m. (11).

Adler. Grier. Mossell. Schloegel.
Allen, E. P. Huizinga. Ramsay. Walz.
Cole. Milroy. Rogers.

Hebrew Exercises: (*Historical Books*). Weekly, Wednesday, 4 p. m. (11).

Adler. Grier. Mossell. Schloegel.
Allen, E. P. Huizinga. Ramsay. Walz.
Cole. Milroy. Rogers.

Biblical Aramaean: (*Critical Interpretation of the Book of Ezra*). Weekly, Wednesday, 3 p. m. (4).

Adler. Huizinga. Ramsay. Schloegel.

Syriac: (*Extracts from Bar Ebhrâyâ's Chronicles in Roediger's Chrestomathy*). Weekly, Tuesday, 3 p. m. (4).

Adler. Huizinga. Ramsay. Schloegel.

Arabic: (*Extracts from Arabic geographers and select suras of the Coran*). Weekly, Tuesday, 11 a. m. (5).

Adler. Huizinga. Philipson. Schloegel.
Arnolt.

Ethiopic: (*Dillmann's Chrestomathy*). Weekly, Tuesday, 12 m. (5).

Adler. Huizinga. Philipson. Schloegel.
Arnolt.

Assyrian: (*Nimrod Epic*). Weekly, Thursday, 11 a. m. (7).

Adler. Frothingham. Philipson. Taylor.
Arnolt. Huizinga. Schloegel.

Sumero-Akkadian: (*Bilingual Hymns and Psalms*). Weekly, Thursday, 12 m. (7).

Adler Frothingham. Philipson. Taylor.
Arnolt. Huizinga. Schoegel.

Babylonian: (*Inscriptions of Nebuchadnezzar, Neriglissar, Nabonidus, etc.*). Weekly, Thursday, 3 p. m. (7).

Adler. Frothingham. Philipson. Taylor.
Arnolt. Huizinga. Schloegel.

Sanskrit and the comparative grammar of the cognate languages. Dr. Bloomfield. (30 Students).

Classes meet in 111 W. Monument St.

Elementary Sanskrit: (*Whitney's Grammar and Lanman's Reader*). Twice weekly, Tuesday and Friday, 12 m. (9).

Elmer. Murray, A. T. Scribner. Steele.
Magoun. Ramsay. Smith, K. W. Stetson.
Moore, J. L.

Advanced Sanskrit: (*Selections from Classical Sanskrit: Rig-Veda*). Twice weekly, Wednesday 11 a. m., Friday 3 p. m. (8).

Christie. Fossum. Lodge. Stetson.
Doubleday. Hussey. Milroy. Walz.

Atharva-Veda and Kauçika-sutra. Weekly, Saturday, 11 a. m. (2).

Smyth, H. W. Spieker.

Comparative Philology: (*Lectures: Whitney's Language and the Study of Language*). Weekly, Monday, 12 m. (19).

Bevan. Hodges. Moore, J. L. Smith, K. W.
Dunlap. Hough. Murray, A. T. Steele.
Elliott, E. S. Hughes. Peirson. Stetson.
Flexner. Lodge. Ramsay. Trueman.
Harry. Magoun. Scribner.

Comparative Grammar of Greek: (*Brugmann's Griechische Grammatik*). Weekly, Thursday, 3 p. m. (21).

Christie. Magonn. Ness. Smith, K. W.
Doubleday. Miller, C. W. E. Peirson. Steele.
Elliott, E. S. Milroy, Ramsay. Stetson.
Fossum. Moore, J. L. Scribner. Trueman.
Hussey. Murray, A. T. Slaughter. Walz.
Lodge.

German. (96 Students).

Classes meet at 111 and 117 W. Monument St.

German Seminary: (*Lübben's Mittelniederdeutsche Chrestomathie; Lauremberg's Niederdeutsche Scherzgedichte*): Dr. Wood. Friday, 10 a. m. to 12 m. (12).

Burton. Egge. Hubbard. Smyth, A. H.
Cummings. Hall, J. L. Learned. Whetham.
Dunlap. Hench. Matzke. Wightman, J. R.

Old Norse: (*Brenner's Handbuch; Möbius's Analecta Norroena*): Dr. Wood. Weekly, Thursday, 9 a. m. (5).

Burton. Egge. Hubbard. Learned.
Crenshaw.

Middle High German: (*Parzival ed. Lachmann*): Dr. Wood. Weekly, Tuesday, 9 a. m. (12).

Allen, E. P. Cummings. Hubbard. Smyth, A. H.
Burton. Dunlap. Learned. Whetham.
Crenshaw. Egge. Matzke. Wightman, J. R.

Old Teutonic Life: (*Lectures*): Dr. Wood. Weekly, Wednesday, 12 m. (13).

Bright. Egge. Hubbard. Smyth, A. H.
Burton. Edmiston. Learned. Whetham.
Crenshaw. Hempl. Matzke. Wightman, J. R.
Dunlap.

Dr. Wood's class in Béowulf is given under English.

(*Major Course*).

German Literature: (*Lectures, with Kluge's Geschichte d. deutschen Literatur*): Dr. Goebel. Weekly, Wednesday, 10 a. m. (7).

Allen, E. P. Jones, C. E. Smyth, A. H. Young.
Boyd. Shefloe. Wiesenfeld.

Selected Readings: (*Masius's Lesebuch, iii*): Dr. Goebel. Weekly, Tuesday, 10 a. m. (7).

Boyd. Jones, C. E. Shefloe. Young.
Cummings. Roberts, B. T. Wiesenfeld.

Goethe: Faust: Dr. Goebel. Twice weekly, Monday and Thursday, 10 a. m. (15).

Allen, E. P. Campbell, G. M. Jones, C. E. Smyth, A. H.
Boyd. Crenshaw. Loeb. Wiesenfeld.
Burnham. Egge. Roberts, B. T. Young.
Burton. Hall, J. L. Shefloe.

Prose Composition: Mr. Hempl. Weekly, Friday, 10 a. m. (9).

Allen, E. P. Cummings. Hall, J. L. Roberts, B. T.
Boyd. Edmiston. Jones, C. E. Young.
Crenshaw.

German Style and Syntax: Dr. Goebel. Second Thursday in each month, 2 p. m. (4).

Boyd. Crenshaw. Edmiston. Shefloe.

(*Minor Course*).

Lessing: *Minna von Barnhelm:* Mr. Hempl.

First Section: Weekly, Monday, 11 a. m. (28).

Allen, P. Dashiell. Hughes. O'Donovan.
Black. Dorsey. Jones, W. Preston.
Brigham. Duvall. Lamb. Reeves.
Browne, A. L. Ensey. Lanier. Taylor, F. W.
Carey. Ferguson. Macaulev. White.
Chisolm. Hahn. Merlwether. Willoughby, W. F.
Daish. Hall, J. L. Miller, W. H. Willoughby, W. W.

Second Section: Twice weekly, Tuesday and Wednesday, 3 p. m. (23).

Bayard. Engle. Jones, W. A. Rogers.
Bechtel. Grier. Lawson. Smith, C. L.
Blandin. Haight. McCabe. Taylor, R. T.
Brown, H. M. Hench. McLane, R. M. Thompson.
Bruyn. Hixson. Meriwether. Williams, W. K.
Cole. Hodges. Milroy.

Goethe: *Egmont:* Dr. Goebel. Twice weekly, Monday and Friday, 2 p. m. (8).

Burnham. Hench. McCabe. Reeves.
Fergnson. Grier. Merlwether. Rogers.

Historical Readings: Dr. Goebel. Twice weekly, Tuesday and Friday, 11 a. m. (13).

Allen, P. Duvall. Hughes. Sanford.
Black. Ferris. Lanier. Willoughby, W. F.
Daish. Hahn. Patrick. Willoughby, W. W.
Dorsey.

Scientific Readings: Mr. Hempl.

First Section: Twice weekly, Tuesday and Friday, 11 a. m. (17).

Brigham. Ensey. Macaulev. Pope.
Browne, A. L. Hixson. Miller, W. H. Reese.
Carey. Jones, W. O'Donovan. Taylor, F. W.
Chisolm. Lamb. Penniman. White.
Dashiell.

Second Section: Twice weekly, Thursday and Friday, 3 p. m. (17).

Bayard. Campbell, G. M. Herrick. McLane, R. M.
Bechtel. Cole. Hodges. Taylor, R. T.
Blandin. Engle. Jones, W. A. Thompson.
Brown, H. M. Haight. Lawson. Williams, W. K.
Bruyn.

Oral Practice: Mr. Hempl. Weekly, Thursday, 11 a. m. (33).

Allen, P.	Dorsey.	Hughes.	Pelrson.
Black.	Duvall.	Jones, W.	Pope.
Brigham.	Ensey.	Lamb.	Preston.
Browne, A. L.	Ferguson.	Lanier.	Reeves.
Burnham.	Hahn.	Macauley.	Taylor, F. W.
Carey.	Hall, J. L.	Miller, W. H.	White.
Chisolm.	Hench.	O'Donovan.	Willoughby, W. F
Daish.	Hixson.	Penniman.	Willoughby, W. W.
Dashiell.			

Prose Composition: Mr. Hempl.

First Section: Weekly, Wednesday, 11 a. m. (35).

Allen, P.	Dorsey.	Lamb.	Ramsay.
Black.	Duvall.	Lanier.	Reeves.
Brigham.	Ensey.	Macauley.	Sanford.
Browne, A. L.	Ferguson.	Miller, W. H.	Stow.
Burnham.	Ferris.	O'Donovan.	Taylor, F. W.
Carey.	Hahn.	Patrick.	White.
Crenshaw.	Hall, J. L.	Penniman.	Willoughby, W. F.
Daish.	Hughes.	Pelrson.	Willoughby, W. W.
Dashiell.	Jones, W.	Preston.	

Second Section: Weekly, Monday, 3 p. m. (21).

Bayard.	Engle.	Hodges.	Meriwether.
Bechtel.	Grier.	Jones, W. A.	Rogers.
Blandin.	Haight.	Lawson.	Taylor, R. T.
Brown, H. M.	Hench.	McCabe.	Thompson.
Campbell.	Hixson.	McLane, R. M.	Williams, W. K.
Cole.			

German Conversation: Dr. Goebel. Daily, 9 a. m. (12).

Allen, E. P.	Edmiston.	Jones, C. E.	Shefloe.
Burnham.	Flexner.	Murray, A. T.	Woods.
Crenshaw.	Gardner.	Patrick.	Young.

Supplementary Class: Mr. Hempl. Tuesday, Thursday, and alternate Fridays, 5 p. m. (12).

Bolglano.	Gooch.	Hoen.	Shemwell.
Duncan.	Henderson.	Jones, H. C.	Warren.
Gilpin.	Hilles.	Reader.	Williams, L. E.

Romance Languages. (50 Students).

Classes meet in 111 and 117 W. Monument St.

Advanced Courses: (*French Phonology; Aucassin et Nicolète; Romance Morphology*): Mr. Elliott. (Two classes). Monday, 10 and 11 a. m. (9).

Crenshaw.	Learned.	McCabe.	Whetham.
Edmiston.	Matzke.	Reeves.	Wightman, J. R.
Gerber.			

Advanced Courses: (*Romance Seminary; Old French Syntax; Italian Dialects*): Mr. Elliott. (Three classes). Wednesday, 10, 11 a. m.; Thursday, 10, 11 a. m. (6).

Bowen.	Gerber.	Whetham.	Wightman, J. R.
Fontaine.	Matzke.		

Advanced Courses: (*Romance Studies in Europe; Langue d' Oïl Dialects*): Mr. Elliott. (Two classes). Tuesday, 10, 11 a. m. (8).

Edmiston.	Gerber.	Matzke.	Whetham.
Egge.	Learned.	McCabe.	Wightman, J. R.

Italian: Dr. Todd. Three times weekly, Monday, Tuesday, and Wednesday, 9 a. m. (6).

Edmiston.	Learned.	Smyth, H. W.	Warner.
Gerber.	McCabe.		

Spanish: Dr. Todd. Twice weekly, Thursday and Friday, 9 a. m. (8).

Edmiston.	Gerber.	McCabe.	Whetham.
Fossum.	Laessig.	Reeves.	Wightman, J. R.

Portuguese and Old Provençal: Dr. Todd. Twice weekly, Tuesday and Friday, 4 p. m. (4).

Matzke.	McCabe.	Whetham.	Wightman, J. R.

French: Major Course: Dr. Todd and Mr. Fontaine. Daily, 10 a. m. (11).

Bowen.	Edmiston.	Laessig.	Whetham.
Crenshaw.	English.	McCabe.	Wightman, J. R.
Cummings.	Hench.	Reeves.	

French: Minor Course: Dr. Todd, Mr. Fontaine, Mr. Bowen. Daily, 12 m. (16).

Brune.	Dorsey.	Ferguson.	Stein.
Chisolm.	Dreyer.	Friedenwald.	Warren.
Crenshaw.	Duncan.	Guggenheimer.	Weech.
Dashiell.	Edmiston.	Harry.	White.

French Composition: Major: Mr. Fontaine. Weekly, Monday, 10 a. m. (7).

Bowen.	Edmiston.	Hench.	Reeves.
Crenshaw.	English.	Laessig.	

French Composition: Minor: Mr. Fontaine. Weekly, Tuesday, 12 m. (17).

Bromwell.	Dreyer.	Guggenheimer.	Stein.
Brune.	Duncan.	Harry.	Warren.
Chisolm.	Ferguson.	Hodges.	Weech.
Dashiell.	Friedenwald.	Hough.	White.
Dorsey.			

French Pronunciation and Conversation: Mr. Fontaine. Three times weekly, Tuesday and Friday, 3 p. m.; Saturday, 9 a. m. (15).

Bowen.	Fossum.	Laessig.	Whetham.
Crenshaw.	Gerber.	Learned.	Wiegand.
Duncan.	Hoffmann.	Matzke.	Wightman, J. R.
Edmiston.	Jones, C. E.	McCabe.	

Supplementary Class: Mr. Bowen. Three times weekly, Monday, Wednesday, and alternate Fridays, 5 p. m. (12).

Ballard.	Carey.	Gilpin.	Sanford.
Bolglano.	Ferris.	Hahn.	Shefloe.
Brigham.	Flexner.	Macauley.	Van Vleck.

English. (57 Students).

Classes meet in 111 and 117 W. Monument St.

Old English Texts: (*Aelfric and Wulfstan*): Dr. Bright. Once weekly, Monday, 4 p. m. (8).

Burton.	Egge.	Hempl.	Hubbard.
Dunlap.	Hall, J. L.	Hench.	Smyth, A. H.

Middle English Texts: (*Ancren Riwle and Octavian*): Dr. Bright. Twice weekly, Tuesday and Thursday, 4 p. m. (8).

Burton.	Egge.	Hempl.	Hubbard.
Dunlap.	Hall, J. L.	Hench.	Smyth, A. H.

Béowulf: Dr. Wood. Twice weekly, Monday and Wednesday, 9 a. m. (13).

Allen, E. P.	Egge.	Hench.	Smyth, A. H.
Burton.	Fossum.	Hubbard.	Whetham.
Cummings.	Hall, J. L.	Learned.	Wightman, J. R.
Dunlap.			

Historical English Grammar: (*Middle English period*): Dr. Bright. Twice weekly, Wednesday and Friday, 4 p. m. (10).

Burton.	Egge.	Hench.	Learned.
Cummings.	Hall, J. L.	Hubbard.	Smyth, A. H.
Dunlap.	Hempl.		

English Seminary: Dr. Bright. Alternate Fridays, 8 p. m. (11).

Burton.	Egge.	Hench.	Learned.
Cummings.	Hall, J. L.	Hubbard.	Smyth, A. H.
Dunlap.	Hempl.	Katzenstein.	

(*Major Course*).

First English Literature, (*with twelve lectures on the Middle English period*): Dr. Bright. Weekly, Monday, 12 m. (8).

Allen, E. P.	Egge.	Hench.	Smyth, A. H.
Cummings.	Hall, J. L.	Hubbard.	Wightman, J. R.

Early English: (*Morris: Specimens of Early English I.; The Tale of Gamelyn, by Skeat*): Mr. Egge. Twice weekly, Tuesday and Thursday, 12 m. (4).

Cummings.	Hall, J. L.	MacEwan.	Shefloe.

Modern English Literature: Dr. Browne. Weekly, Friday, 12 m. (2).

Brackett, J. R.	Shefloe.

(*Minor Course*).

Anglo-Saxon: Dr. Bright. Twice weekly, Monday and Wednesday, 11 a. m. (Two classes). (9). (1).

Allen, E. P.	Hall, J. L.	Smyth, A. H.	Whetham.
Cummings.	Shefloe.	Tarleton.	Wightman, J. R.
Edmiston.			

Fourteenth Century Literature: Dr. Browne. Twice weekly, Tuesday and Thursday, 11 a. m. (3).

Hamilton.	Poullain.	Tarleton.

Eighteenth Century Literature: Dr. Browne. Weekly, Friday, 11 a. m. (3).

Brackett, J. R.	Hubbard.	Tarleton.

English Literature: (*P. H. E. Course*): Dr. Browne. Twice weekly, Wednesday and Thursday, 12 m. (37).

Allen, P.	Devries.	Jones, W.	Reader.
Ballard.	Dorr.	Lanier.	Rosenthal.
Bechtel.	Duvall.	Loeb.	Simon.
Black.	Fearn.	Macauley.	Sloan.
Boyd.	Ferris.	Mann.	Tarleton.
Brigham.	Forrest.	Miller, W. H.	Taylor, F. W.
Brown, H. M.	Gildersleeve.	Moore, G. N.	Taylor, R. T.
Browne, A. L.	Hahn.	Patterson.	Willoughby, W. F.
Carey.	Hilles.	Poullain.	Willoughby, W. W.
Daish.			

History and Political Science. (94 Students).

Classes meet in the Historical rooms.

Seminary of History and Politics: Dr. Adams. Two hours weekly, Friday, 8–10 p. m. (20).

Applegarth, A. C.	Egge.	Newton.	Sato.
Ayres.	Fisher.	Ota.	Smith, C. L.
Bliss.	Gardner.	Randall, D. R.	Vincent.
Brackett, J. R.	Holcomb.	Roberts, B. T.	Warner.
Dewey.	Katzenstein.	Sanford.	Williams, L.

History of Politics: DR. ADAMS. Twice weekly, Wednesday and Thursday, 11 a. m. (19).

Applegarth, A. C.	Egge.	Moore, J. L.	Randall, D. R.
Ayres.	Fisher.	Newton.	Sato.
Boston.	Gardner.	Ota.	Smith, C. L.
Brackett, J. R.	Holcomb.	Pleasants, R. H.	Warner.
Dewey.	Jones, C. E.	Poe.	

Renaissance: DR. ADAMS. Twice weekly, Monday and Tuesday, 11 a. m. (16).

Bevan.	Forrest.	Jones W. A.	Smith, C. L.
Bliss.	Gordon.	Patterson.	Tuska.
Brune.	Guggenheimer.	Roberts, B. T.	Wiesenfeld.
Fifield.	Hoffmann.	Rouse.	Young.

International Law: DR. ADAMS. Twice weekly, Monday and Tuesday, 12 m. (15).

Ayres.	Doub.	Ota.	Williams, W. K.
Bayard.	Fifield.	Pleasants, R. H.	Woods.
Bliss.	Jones, C. E.	Warner.	Young.
Davis.	Meriwether.	Williams, L.	

Studies in Administration: DR. ELY. Weekly, Friday, 10 a. m. (14).

Applegarth, A. C.	Ferguson.	Randall, D. R.	Sato.
Ayres.	Gardner.	Sams.	Smith, C. L.
Burnham.	Holcomb.	Sanford.	Warner.
Dewey.	Ota.		

Advanced Political Economy: DR. ELY. Three times weekly, Tuesday, Wednesday, and Thursday, 10 a. m. (18).

Applegarth, A. C.	Coler, G. P.	Katzenstein.	Sanford.
Ayres.	Dewey.	Ota.	Sato.
Berry.	Ferguson.	Randall, D. R.	Smith, C. L.
Blair.	Gardner.	Sams.	Warner.
Burnham.	Holcomb.		

Elements of Political Economy: (*Minor Course*): DR. ELY. Daily, 1 p. m. (16).

Bliss.	Gordon.	McPherson.	Sloan.
Brune.	Goggenheimer.	Preston.	Smith, C. L.
Davis.	Jones, W. A.	Roberts, B. T.	Tuska.
Dorsey.	McLane, A.	Rouse.	Willis.

English and French History: DR. JAMESON. Three times weekly, Wednesday, Thursday, and Friday, 11 a. m. (14).

Bliss.	Forrest.	Meriwether.	Rouse.
Brune.	Gordon.	Patterson.	Tuska.
Davis.	Guggenheimer.	Roberts, B. T.	Wiesenfeld.
Fifield.	Jones, W. A.		

Thucydides (in Translation): DR. JAMESON. Weekly, Monday, 9 a. m. (10).

Applegarth, A. C.	Daish.	Hilles.	Willoughby, W. F.
Bayard.	Gordon.	Reader.	Willoughby, W. W.
Black.	Hahn.		

American Constitution: DR. JAMESON. Three times weekly, Wednesday and Thursday, 12 m., Friday, 2 p. m. (16).

Applegarth, A. C.	Boston.	Meriwether.	Williams, L.
Bayard.	Davis.	Pleasants, R. H.	Williams, W. K.
Bevan.	Doub.	Poe.	Woods.
Bliss.	Fifield.	Rouse.	Young.

Physical and Historical Geography: (*P. H. E. Course*): DR. JAMESON. Weekly, Friday, 12 m. (39).

Allen, P.	Cradock.	Hilles.	Reader.
Ballard.	Daish.	Jones, W.	Rosenthal.
Bechtel.	Devries.	Lanier.	Simon.
Black.	Dorr.	Loeb.	Swartz.
Bolgiano.	Duvall.	Macauley.	Tarleton.
Boyd	Fearn.	Mann.	Taylor, F. W.
Brigham.	Ferris.	Miller, W. H.	Taylor, R. T.
Brown, H. M.	Forrest.	Moore, G. N.	Willoughby, W. F.
Browne, A. L.	Gildersleeve.	Patterson.	Willoughby, W. W.
Carey.	Hahn.	Poullain.	

Greek and Roman History: (*P. H. E. Course*): DR. JAMESON. Twice weekly, Monday and Tuesday, 12 m. (34).

Ballard.	Carey.	Hahn.	Reader.
Bechtel.	Cradock.	Hilles.	Rosenthal.
Black.	Daish.	Jones, W.	Simon.
Bolgiano.	Dorr.	Lanier.	Tarleton.
Boyd.	Duvall.	Loeb.	Taylor, F. W.
Brigham.	Fearn.	Miller, W. H.	Taylor, R. T.
Bromwell.	Ferris.	Patterson.	Willoughby, W. F.
Brown, H. M.	Forrest.	Poullain.	Willoughby, W. W.
Browne, A. L.	Gildersleeve.		

General European History: (*P. H. E. Course*): MR. HOLCOMB. Twice weekly, Monday and Tuesday, 12 m. (6).

Allen, P.	Macauley.	O'Donovan.	Moore, G. N.
Devries.	Mann.		

Psychology and Pedagogics. PROFESSOR HALL. (45 Students).

History of Philosophy. Weekly, Monday, 12 m., 113 W. Monument St. (22).

Adler.	Fields.	Mansfield.	Nuttall.
Blair.	Fisher.	Milroy.	Patrick.
Burnham.	Gardner.	Motora.	Sanford.
Burton.	Hixson.	Newton.	Walz.
Christie.	Hussey.	Nixon.	Wiesenfeld.
Crowell.	Jastrow.		

Psychology. Weekly, Wednesday, 12 m., Biological Laboratory. (17).

Adler.	Coler, G. P.	Hixson.	Nelson.
Blair.	Crowell.	Jastrow.	Nixon.
Bruce.	Halght.	Mansfield.	Nuttall.
Burnham.	Hemmeter.	Motora.	Sanford.
Coler, C. S.			

Education. Weekly, Friday, 12 m., Biological Laboratory. (38).

Adler.	Crowell.	Hubbard.	Nelson.
Bell, L.	Egge.	Hussey.	Nuttall.
Blair.	Fields.	Jastrow.	Palmer, C. S.
Bliss.	Fisher.	Katzenstein.	Sanford.
Bowen.	Gardner.	Kemp.	Slaughter.
Burnham.	Halght.	Mansfield.	Whetham.
Campbell, G. M.	Hayes.	Milroy.	Wiesenfeld.
Christie.	Hemmeter.	Motora.	Wightman, J. R.
Coler, C. S.	Hixson.	McWhirter.	Woodhull.
Coler, G. P.	Holcomb.		

Histology of Sense Organs: DR. DONALDSON. Weekly (during February), Wednesday, 2–5 p. m. (6).

Burnham.	Jastrow.	Nuttall.	Sanford.
Crowell.	Nelson.		

The following students are engaged in psycho-physical experiments.

Jastrow.	Motora.	Nixon.	Nuttall.

The Ethical Club meets at 113 Monument St., Wednesday, 8 p. m.

Blair.	Coler, G. P.	Hixson.	Patrick.
Burnham.	Crowell.	Mansfield.	Sanford.
Coler, C. S.	Fisher.	Motora.	

Seminary [psycho-physics] meets weekly, Monday, 8 p. m. (4).

Hemmeter.	Jastrow.	Motora.	Nuttall.

Ethics. (*L. E. P. Course*): PROFESSOR HALL. Daily, 1 p. m. (29).

Applegarth, E. C.	English.	Hughes.	Williams, J. W.
Bevan.	Flexner.	Laessig.	Williams, L.
Buckler.	Gorton.	Meriwether.	Williams, W. K.
Coates.	Harry.	Pleasants, R. H.	Wingert.
Dohme.	Hartogensis.	Smith, W. F.	Winslow.
Doub.	Hodges.	Stein.	Woods.
Duffy.	Hough.	Weech.	Young.
Eichelberger.			

Drawing. MR. NEWELL. (63 Students).

Free-Hand Drawing. Daily (except Wednesday), 1 p. m. (57).

Ballard.	Flexner.	Jones, H. C.	Simon.
Black.	Forrest.	Jones, W. A.	Stein.
Bolgiano.	Friedenwald.	Jones, W.	Stow.
Brigham.	Gildersleeve.	Macauley.	Straus.
Bromwell.	Glenn.	McMurrich.	Taylor, F. W.
Browne, A. L.	Gordon.	McPherson.	Taylor, R. T.
Brune.	Gorton.	Mann.	Weech.
Buckler.	Guggenheimer.	Meriwether.	White.
Carey.	Harry.	Miller, W. H.	Wiegand.
Chisolm.	Hodge.	Moore, G. N.	Williams, J. W.
Dashiell.	Hodges.	Penniman.	Wingert
Dorr.	Hoffmann.	Reader.	Winslow.
Dreyer.	Hough.	Reeves.	Woods.
Duffy.	Hughes.	Shemwell.	Young.
Ferris.			

Mechanical Drawing. Saturday, at 2 p. m. (7).

Class I.	Laessig.	Ensey.	
Class II.	Dohme.	Hodges.	Wiegand.
	Glenn.	Taylor, F. W.	

Perspective Drawing. (44).

Class I. Saturdays, at 1 p. m.

Brigham.	Ensey.	Macauley.	Stein.
Buckler.	Flexner.	McPherson.	Weech.
Dashiell.	Hoffmann.	Meriwether.	Williams, J. W.
Dorr.	Jones, W. A.	Reeves.	Winslow.
Duffy.	Laessig.	Simon.	

Class II. Thursday, at 1 p. m.

Black.	Carey.	Fifield.	Reader.
Bolgiano.	Duffy.	Friedenwald.	Weech.
Bromwell.			

Class III. Thursday, at 3 p. m.

Ballard.	Forrest.	Hughes.	White.
Brigham.	Guggenheimer.	Jones, W.	Wiegand.
Browne, A. L.	Harry.	Miller, W. H.	Wightman, A. C.
Brune.	Hodges.	Pleasants, R. H.	Wingert.
Flexner.	Hough.	Taylor, F. W.	Young.

Elocution. MR. WOODWORTH. Daily, 9 a. m. to 12.30 p. m. (56 Students).

Ames.	Carey.	Helfenstein.	Penniman.
Ayres.	Cummings.	Hixson.	Pleasants, R. H.
Ballard.	Daish.	Hodges.	Reader.
Bechtel.	Dashiell.	Hoffmann.	Reeves.
Bevan.	Devries.	Jones, C. E.	Shemwell.
Black.	Dreyer.	Jones, W.	Stow.
Blair.	Duvall.	Macauley.	Tarleton.
Boyd.	Fearn.	McLane, R. M.	Thompson.
Brigham.	Flexner.	McPherson.	Weech.
Bromwell.	Forrest.	Meriwether.	White.
Browne, A. L.	Gildersleeve.	Miller, W. H.	Williams, J. W.
Buckler.	Gilpin.	Moore, G. N.	Willoughby, W. F.
Brune.	Gordon.	O'Donovan.	Willoughby, W. W.
Burnham.	Grier.	Palmer, O. H.	Young.

HOURS FOR LECTURES AND RECITATIONS, SECOND HALF-YEAR, 1885-86.

Hours.	MONDAY.	TUESDAY.	WEDNESDAY.	THURSDAY.	FRIDAY.	SATURDAY.
A. M.	Carbon Compounds. (Remsen.) Latin Prose. (Spieker.) Hist. of Morphology. (Brooks.) Italian. (Todd.)	Carbon Compounds. (Remsen.) Horace. (Spieker.)	General Chemistry. (Remsen.) Horace. (Spieker.) Hist. of Morphology. (Brooks.) Italian. (Todd.)	General Chemistry. (Remsen.) Horace. (Spieker.)	General Chemistry. (Remsen.) Horace. (Spieker.) Hist. of Morphology. (Brooks.)	
9	Beowulf. (Wood.) Mineralogy: Elem. (Williams.)	Italian. (Todd.) Middle High German. (Wood.)	Beowulf. (Wood.)	Spanish. (Todd.) Old Norse. (Wood.) Theoretical Chemistry. (Morse.) Astronomy. (Newcomb.)	Spanish. (Todd.) Theoretical Chemistry. (Morse.)	French Conversation. (Fontaine.) Mineralogy: Adv. (Williams.)
	Mathematical Seminary. (Craig.) Thucydides: Trans.: (Jameson.)	Astronomy. (Newcomb.)				
	German Conversation. (Goebel.) Elocution. (Woodworth.)	German Conversation. (Goebel.) Elocution. (Woodworth.)	German Conversation. (Goebel.) Elocution. (Woodworth.)	German Conversation. (Goebel.) Elocution. (Woodworth.)	German Conversation. (Goebel.) Elocution. (Woodworth.)	
	General Physics. (Kimball.) General Biology. (Martin.)	General Physics. (Kimball.) Osteology. (McMurrich.)	General Physics. (Kimball.) General Biology. (Martin.)	General Physics. (Kimball.) Osteology. (McMurrich.)	General Physics. (Kimball.) General Biology. (Martin.)	
	Greek Seminary. (Gildersleeve.)	Greek Syntax. (Gildersleeve.)	Greek Seminary. (Gildersleeve.)	Greek Syntax. (Gildersleeve.)	Greek Philos. Lit. (Gildersleeve.)	
	Light. (Rowland.)	Light. (Rowland.)	Light. (Rowland.)	Light. (Rowland.)	Light. (Rowland.)	
	German: Major. (Goebel.)	German: Major. (Goebel.)	German: Major. (Goebel.)	German: Major. (Goebel.)	German: Major. (Hempl.)	
	French Comp.: Major. (Fontaine.)	French: Major. (Todd.)	French: Major. (Todd.)	French: Major. (Todd.)	French: Major. (Todd.)	
10	Latin Prose. (Moore.)	Tacitus. (Moore.)	Tacitus. (Moore.)	Tacitus. (Moore.)	Tacitus. (Moore.)	
	Latin Prose. (Warren.)	Pliny and Juvenal. (Warren.)	Latin at sight. (Warren.)	Pliny and Juvenal. (Warren.)	Pliny and Juvenal. (Warren.)	
	French Phonology. (Elliott.)	Langue d'Oil Dialects. (Elliott.)	Italian Dialects. (Elliott.)	Romance Seminary. (Elliott.)		
						Mineralogy: Adv. (Williams.)
		Political Economy: Adv. (Ely.)	Political Economy: Adv. (Ely.)	Political Economy: Adv. (Ely.)	Studies in Administration. (Ely.)	
	Ellip. and Abelian Functs. (Craig.)	Linear Diff. Equations. (Craig.)	Ellip. and Abelian Functs. (Craig.)	Linear Diff. Equations. (Craig.)	Ellip and Abelian Functs. (Craig.)	
					German Seminary. (Wood.)	
	Elocution. (Woodworth.)	Elocution. (Woodworth.)	Elocution. (Woodworth.)	Elocution. (Woodworth.)	Elocution. (Woodworth.)	
	German: Minor. (Hempl.)	German: Minor. (Hempl.)	German: Minor. (Hempl.)	German: Minor. (Hempl.)	German: Minor. (Hempl.)	
	Renaissance. (Adams.)	Renaissance. (Adams.)	English & French Hist. (Jameson.)	English & French Hist. (Jameson.)	English & French Hist. (Jameson.)	
	Latin: Practical Exers. (Warren.)	Latin Seminary. (Warren.)		Latin Grammar. (Warren.)	Latin Seminary. (Warren.)	
	Greek Prose. (Spieker.)	Homer. (Spieker.)	Homer. (Spieker.)	Homer. (Spieker.)	Homer. (Spieker.)	
	Solid Analytic Geom. (Franklin.)	Differential Equations. (Craig.)	Solid Analytic Geom. (Franklin.)	Differential Equations. (Craig.)	Solid Analytic Geom. (Franklin.)	
		German: Minor: Hist. (Goebel.)			German: Minor: Hist. (Goebel.)	
	English: Minor. (Bright.)	English: Minor. (Browne.)	English: Minor. (Bright.)	English: Minor. (Browne.)	English: Minor. (Browne.)	
11		Arabic. (Haupt.)		Assyrian. (Haupt.)		
		Romance Studies. (Elliott.)	Old Fr. Syntax. (Elliott.)	Romance Seminary. (Elliott.)		
	Romance Morphology. (Elliott.)	Animal Physiol. & Histol. (Martin.)	Animal Physiol. & Histol. (Martin.)	Animal Physiol. & Histol. (Martin.)		
	General Zoology. (Brooks.)		History of Politics. (Adams.)	History of Politics. (Adams.)	General Zoology. (Brooks.)	
			Mineralogy: Adv. (Williams.)	Mineralogy: Adv. (Williams.)	Mineralogy: Adv. (Williams.)	Mineralogy: Adv. (Williams.)
			Sanskrit: Adv. (Bloomfield.)			Atharva-veda and Kauçika-Sûtra. (Bloomfield.)
	Int. Course for Grad. (Story.)	Int. Course for Grad. (Story.)	Int. Course for Grad. (Story.)	Int. Course for Grad. (Story.)	Int. Course for Grad. (Story.)	
	Elocution. (Woodworth.)	Elocution. (Woodworth.)	Elocution. (Woodworth.)	Elocution. (Woodworth.)	Elocution. (Woodworth.)	
	Hist. of Philosophy. (Hall.)		Psychology. (Hall.)		Education. (Hall.)	
M.	French: Minor. (Todd.)	French: Minor. (Todd.)	French: Minor. (Todd.)	French: Minor. (Todd.)	French: Minor. (Todd.)	
	Greek Prose. (Christie.)	Sophocles. (Christie.)	Sophocles. (Christie.)	Sophocles. (Christie.)	Sophocles. (Christie.)	
		Ethiopic. (Haupt.)		Sumero-Akkadian. (Haupt.)		
		Theory of Probabilities. (Story.)		Theory of Probabilities. (Story.)		
	International Law. (Adams.)	International Law. (Adams.)				
	Gr. & Rom. Hist.: P.H.E. (Jameson.)	Gr. & Rom. Hist.: P.H.E. (Jameson.)	American Constitution. (Jameson.)	American Constitution. (Jameson.)	Phys. and Hist. Geography: P.H.E. (Jameson.)	
12	English: Major. (Bright.)	English: Major. (Egge.)		English: Major. (Egge.)	English: Major. (Browne.)	
	European Hist.: P.H.E. (Holcomb.)	European Hist.: P.H.E. (Holcomb.)	English Lit.: P. H. E. (Browne.)	English Lit.: P. H. E. (Browne.)		
	Comparative Philol. (Bloomfield.)	Sanskrit: Elem. (Bloomfield.)			Sanskrit: Elem. (Bloomfield.)	
	Physics: Major. (Kimball.)	Physics: Major: (Kimball.)	Physics: Major. (Kimball.)	Physics: Major. (Kimball.)	Physics: Major. (Kimball.)	
		French Comp.: Minor. (Fontaine.)	Lectures. (Wood.)	Greek Dialects. (Smyth.)		
	Physiol. of Respiration. (Howell.)					
	Elocution. (Woodworth.)	Elocution. (Woodworth.)	Elocution. (Woodworth.)	Elocution. (Woodworth.)	Elocution. (Woodworth.)	
	Elasticity. (Craig.)		Elasticity. (Craig.)		Elasticity. (Craig.)	
P. M.	Calculus. (Franklin.)	Conic Sections. (Story.)	Calculus. (Franklin.)	Conic Sections. (Story.)	Calculus. (Franklin.)	
		Hebrew: Elem. (Haupt.)				
1	Anal. Geom.: Adv. (Story.)		Anal. Geom.: Adv. (Story.)		Anal. Geom.: Adv. (Story.)	
	Polit. Econ.: Minor. (Ely.)	Polit. Econ.: Minor. (Ely.)	Polit. Econ.: Minor. (Ely.)	Polit. Econ: Minor. (Ely.)	Polit. Econ.: Minor. (Ely.)	
	Ethics: (Hall.)	Ethics. (Hall.)	Ethics. (Hall.)	Ethics. (Hall.)	Ethics. (Hall.)	
	Drawing. (Newell.)	Drawing. (Newell.)		Drawing. (Newell.)	Drawing. (Newell.)	Drawing. (Newell.)
					American Constitution. (Jameson.)	
2	German: Minor. (Goebel.)			German: Minor. (Goebel.) (Alternate Thursdays.)	German: Minor. (Goebel.)	
	Drawing. (Newell.)	Drawing. (Newell.)		Drawing. (Newell.)	Drawing. (Newell.)	Drawing. (Newell.)
			Mathem. Seminary. (Newcomb.)			
		French: Conversation. (Fontaine.)			French Conversation. (Fontaine.)	
3		Syriac. (Haupt.)	Biblical Aramaean. (Haupt.)	Babylonian. (Haupt.)		
				Comp. Gram. of Greek. (Bloomfield.)	Sanskrit: Adv. (Bloomfield.)	
	German: Minor. (Hempl.)	German: Minor. (Hempl.)	German: Minor. (Hempl.)	German: Minor. (Hempl.)	German: Minor. (Hempl.)	
	Drawing. (Newell.)	Drawing. (Newell.)		Drawing. (Newell.)	Drawing. (Newell.)	Drawing. (Newell.)
	Analytic Geometry. (Franklin.)		Analytic Geometry. (Franklin.)		Analytic Geometry. (Franklin.)	
			Hebrew Exercises. (Haupt.)	Hebrew: Elem. (Haupt.)	Hebrew: Elem. (Haupt.)	
		Portuguese. } (Todd.)			Portuguese. } (Todd.)	
4		Old Provençal. }			Old Provençal. }	
	Old English Texts. (Bright.)	Middle Eng. Texts. (Bright.)	Hist. English Gr. (Bright.)	Middle Eng. Texts. (Bright.)	Hist. English Gr. (Bright.)	
	Latin. (Slaughter.)		Latin. (Slaughter.)		Latin. (Slaughter.)	
	Drawing. (Newell.)	Drawing. (Newell.)		Drawing. (Newell.)	Drawing. (Newell.)	Drawing. (Newell.)
	French Elem. (Bowen.)		French: Elem. (Bowen.)		French: Elem. (Bowen.) (Alternate Fridays.)	
5	Problems in Mechanics. (Franklin.)	German: Suppl. (Hempl.)		Mathem. Seminary. (Story.) German: Suppl. (Hempl.)	Problems in Mechanics. (Franklin.) German: Suppl. (Hempl.) (Alternate Fridays.)	

The public lectures begin at 5 p. m.

AMERICAN JOURNAL OF MATHEMATICS.

Published under the Auspices of the Johns Hopkins University.

The American Journal of Mathematics, founded under the auspices of the Johns Hopkins University, in 1878, was conducted by Professor Sylvester during the period of his connection with the University. It is now under the direction of SIMON NEWCOMB (Foreign Member of the Royal Society, and Corresponding Member of the Institute of France), Professor of Astronomy and Mathematics in the Johns Hopkins University and Director of the U. S. Nautical Almanac, as EDITOR, and of THOMAS CRAIG, Ph. D., Associate Professor of Applied Mathematics, as ASSOCIATE EDITOR.

The Journal has published, since its commencement in 1878, original communications from eminent mathematicians residing in England, France, Germany, Italy, Denmark, the Dominion of Canada, and this country, as shown in the subjoined list:

EUROPEAN CONTRIBUTORS.—ARTHUR CAYLEY, W. K. CLIFFORD, M. W. CROFTON, FAÀ DE BRUNO, A. FRANKLAND, A. DE GASPARIS, J. C. GLASHAN, J. HAMMOND, C. HERMITE, A. B. KEMPE, R. LIPSCHITZ, J. LOUDON, E. LUCAS, P. A. MACMAHON, T. MUIR, J. PETERSEN, H. POINCARÉ, S. ROBERTS, G. WEICHOLD, G. P. YOUNG.

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The subjects treated have been of a very varied character, including Professor Sylvester's papers on the Chemico-Algebraic Theory, with Clifford's, Frankland's and Mallet's remarks on the same, Tables of Invariants computed at the expense of the British Association, Hill's researches on the Lunar Theory, Newcomb's remarks on 4-dimensional Geometry, papers by Story and Stringham on Non-Euclidean and Hyperspatial Geometry, Professor Cayley's great memoir on the Abelian and Theta Functions, Hermite on the Theory of Functions, Peirce on the Algebra of Logic and the Ghosts of Diffraction Spectra, Rowland on Vortex Fluid Motion, Story on Elasticity, Craig on Theta Functions, Franklin on Cubic Curves, Hall on Electro-Magnetic Action, MacMahon on Symmetric Functions, Sylvester on Universal Algebra, and numerous others of no less value and originality.

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Communications in regard to subscriptions and exchanges should be addressed to the

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BALTIMORE, MD.

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JOHNS HOPKINS UNIVERSITY CIRCULARS

Published with the approbation of the Board of Trustees

VOL. V.—No. 48.] BALTIMORE, APRIL, 1886. [PRICE, 10 CENTS.

PUBLICATIONS ISSUED UNDER THE AUSPICES OF THE UNIVERSITY.

I. American Journal of Mathematics.

The publication of this journal commenced in 1878, under the editorial direction of Professor Sylvester. It is now conducted by Professor Simon Newcomb, as Editor, and Dr. T. Craig, as Associate Editor. Seven volumes of about 400 pages each have been issued and the eighth is in progress. It appears quarterly, in the quarto form. Subscription $5 per year. Single numbers $1.50.

II. American Chemical Journal.

This journal was commenced in 1879, with Professor Remsen as Editor. Seven volumes of about 450 pages each have been issued, and the eighth is in progress. It appears bi-monthly. Subscription $3 per year. Single numbers 50 cents.

III. American Journal of Philology.

The publication of this journal commenced in 1880, under the editorial direction of Professor Gildersleeve. Six volumes of about 570 pages each have been issued, and the seventh is in progress. It appears four times yearly. Subscription $3 per volume. Single numbers $1.00.

IV. Studies from the Biological Laboratory.

(Including the Chesapeake Zoölogical Laboratory.)

The publication of these papers commenced in 1879, under the direction of Professor Martin, with the assistance of Dr. W. K. Brooks. Two volumes of about 500 pages octavo, and 40 plates each, have been issued, and the third is in progress. Subscription $5 per volume.

V. Studies in Historical and Political Science.

The publication of these papers was begun in 1882, under the editorial direction of Dr. H. B. Adams. A first series of 470 pages, a second of 630 pages and a third series of 595 pages are now completed, and a fourth series is in progress. Subscription $3 per volume.

VI. Johns Hopkins University Circulars.

The University Circulars are published at convenient intervals during the academic year for the purpose of communicating intelligence to the various members of the University in respect to work which is here in progress, as well as for the purpose of promulgating official announcements from the governing and teaching bodies. Although these circulars are designed for the members of the University, they have frequently been called for by institutions and libraries at a distance, and also by individuals who are interested in the literary and scientific activity of this University. Subscriptions and exchanges are therefore received.

The publication of the Circulars began in December, 1879, and forty-eight numbers have since been issued. Subscription $1 per year. Subscribers to the Circulars will also receive the Annual Register and the Annual Report of the University.

VII. Annual Report.

Presented by the President to the Board of Trustees, reviewing the operations of the University during the past academic year.

VIII. Annual Register.

Giving the list of the officers and students, and containing detailed statements as to the regulations and work of the University.

Announcements of proposed lectures, courses of instruction, etc., appear in the University Circulars, or are separately issued as Programmes from time to time.

During the year 1885–86, in addition to the current journals named above, there have been issued by the University:

Photograph of the Normal Solar Spectrum. Made by Professor H. A. Rowland. 1886. Set of seven plates unmounted $10, mounted $12; single plates unmounted $2, mounted $2.25.

Reproduction in Phototype of a Syriac MS. with the Antilegomena Epistles. (Including seventeen phototype pages, each on a separate leaf, besides additional pages containing descriptive and explanatory matter.) Edited by Dr. I. H. Hall. 250 copies. 1886. $3.

Communications in respect to exchanges and remittances may be sent to the Johns Hopkins University (Publication Agency,) Baltimore, Maryland.

LIST OF STUDENTS IN THE JOHNS HOPKINS UNIVERSITY

DURING ITS FIRST TEN YEARS, 1876–86.

CORRECTED TO MARCH 31, 1886.

ABBREVIATIONS.

A = Associate.
A Prof. = Associate Professor.
As't = Assistant.
As't Prof. = Assistant Professor.
Balt. C. C. = Baltimore City College.
C = Candidate for Matriculation.
C Z L = Chesapeake Zoölogical Laboratory.
F = Fellow.
F by C = Fellow by Courtesy.
G = Graduate Student.
G S = Graduate or University Scholar.
H S = Hopkins Scholar.
H H S = Honorary Hopkins Scholar.
Instr. = Instructor.
Lect. = Lecturer.
M = Matriculated Student.
P M = Student in course Preliminary to Medicine.
S = Special Undergraduate Student.
W S = Washington Scholar.

EXAMPLE.

Balt. C. C. 1876 (Graduate of Baltimore City College, 1876) A. B. 80, Ph. D. 83 (Bachelor of Arts, and Doctor of Philosophy, Johns Hopkins University, 1880 and 1883) M 77-80 (Matriculated Student J. H. U., 1877-80) G S 80-81 (Graduate Scholar J. H. U., 1880-81) F 81-83 (Fellow J. H. U., 1881-83).

Where no place or station is named the Johns Hopkins University may be understood. The present residence is, in most cases, given after the name; in cases where this is not known, the residence at the time of the student's connection with the University is stated. The residence, as recorded in the current Register, is given in the case of students now connected with the University. Deaths are indicated by an asterisk *. The names of a few persons who were appointed to Fellowships but did not hold that position, are included in the list.

Abbott, Alexander Crever (Balt. C. C., M. D. Univ. Md. 84), G 85-6, Physician, Baltimore.
Abel, John J. (Ph. B. Mich. 83), G 83-4, Student in Leipsic, Germany.
Aber, William Martin (A. B. Yale 78), G 84-5, Waterbury, Conn.
Adams, Frank Dawson (B. S. McGill Univ. 78), G 83-4, Lithologist, Geol. Survey of Canada, Ottawa.
Adams, Henry Carter (A. B. Iowa Coll. 74, A. M. Iowa 77, Ph. D. 78), F 76-8, Instr. Pol. Econ. 79-81, Lect. Pol. Econ. Univ. of Mich. 80-, Lect. and A. Prof. Pol. Econ. Cornell, 79-, Ithaca, N.Y.
Adams, Herbert Baxter (A. B. Amh. 72, Ph.D. Heidelb. 76), Sec. Am. Hist. Assoc., Corr. Memb. Mass. Hist. Soc., F 76-8, A 78-83, A Prof. of Hist. 83-, Ed. Univ. Studies in Hist. and Pol. Sci., Baltimore.
Adams, Joseph Henry (A. B. Amh. 70), G 79-80, Instr. Adelphi Acad., Brooklyn, N. Y.
Adkins, Franklin Bache (Berkeley Div. Sch.), S 79-80, Clergyman of P. E. Church, Wicomico, Md.
Adkins, William Hughlett (A. B. 82, LL. B. Univ. Md. 83), C 79-80, M 80-2, G 82, Att'y at Law, Baltimore.
Adler, Cyrus (A. B. Univ. Pa. 83), G 83-4, G S 84-5, F 85-6, Philadelphia.
Alden, Edmund Kimball (A. B. Amh. 80), G 83-4, Century Co., N. Y.
Alexander, William John (A. B. Lond. 76, Ph. D. 82), G 79-80, G S 80-1, F 81-3, Prof. of Eng. Lit. Dalhousie Coll. Halifax, N. S.
Allen, Edgar Pierce (A. B. Emory Coll. Ga. 85), G 85-6, Shanghai, China.
Allen, Paul, C 85-6, New York City.
Allinson, Francis Greenleaf (A. B. Haverf. 76 and Harv. 77, Ph. D. 80), F 77-80, As't Prof. Latin and Greek, Haverf. 80-2, Classical Instructor, Baltimore.
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Fay, Edward Allen (A.B. Univ. Mich. 62, A.M. Mich. 65, Ph.D. 81), G 77-81, Prof. Latin and Hist. Nat'l Deaf Mute Coll., Washington, D.C.
Fearn, Thomas Spear, P M 85-6, Summit, N.J.
Fels, Maurice (A.B. 83, LL.B. Univ. Pa. 86), C 80-1, M 81-3, Att'y at Law, Philadelphia, Pa.
Ferguson, William Clements, S 84-6, Richmond, Ind
Ferris, Cornelius, Jr., S 84-6, Denver, Colo.
Field, Burr Kellogg (Ph.B. Yale 77), G 77-8, Mt. Washington, Md.
Fields, John Charles (A.B. Toronto 84), G and F 84-6, Hamilton, Ont.
Fifield, James Clark, C 83-4, M 84-6, Kearney, Neb.
Fifield, Lebbeus Bailey (A.B. Amh. 53, A.M. Amh. 71), G 82-3, Baltimore.
Fink, James A., S 83-4, Baltimore.
Finley, John Park (B.S. Mich. Ag. Coll. 78, M.S. Mich. Ag. 81), F by C 82-3, Lieut. U.S. Signal Corps, Washington, D.C.
Fisher, John Alonzo (Ph.B. Ill. Wesl. 80), G 83-6, Clergyman R.E. Church, Baltimore.
Fitzgerald, Delano S. (M.D. Univ. France 80), G 80-1, Physician, Baltimore.
Fleming, William Scott (A.B. Davids. 78), G 80-1, G S 81-2, F 82-3, Prof. Greek and German, Davidson Coll. 83-5, Wetumpka, Ala.
Fletcher, Lawrence Bunting (A.B. Columbia 77, A.M. Columbia 80, Ph.D. 81), Fellow of Columbia Coll. 77-80, G 78-9, F by C 79-80, F 80-1, Instr. in Physics, Wesleyan Univ. 82-3, Marlborough, N.Y.
Flexner, Abraham, C 84-5, M 85-6, Louisville, Ky.
Fontaine, Joseph Auguste (Coll. of Nancy, France, 79), G 83-6, Rue, France.
Forrest, Clarence Henry, C 85-6, Baltimore.
Fossum, Andrew (A.B. Norw. Luth. 82), G 83-6, Elon, Iowa.
Fowler, Harold North (A.B. Harv. 80), G 80-1, Amer. School at Athens 82-3, Instr. in Greek, Harvard College.
France, Joseph Chalmers (Balt. C.C. 79, LL.B. Univ. Md 83), S 80-1, Att'y at Law, Baltimore.
Franklin, Fabian (Ph.B Columbian 69, Ph.D. 80), G 70-7, F 77-9, As't 79-82, A. Math. 82-, Baltimore.
Frederick, Henry Alfred, S 83-4, Douglass, Pa.
Freeman, Spencer Hedden (A.B. Roch. 75, A.M. Roch. 78), G 79-80, F 80-2, Prof. Physics and Astron. Adelbert College, 82-6, * *February* 3, 1886.
Frick, Charles, (Balt. C.C.), P M 80-1, C 81-2, Baltimore.
Friedenwald, Harry (Balt. C.C., A.B. 84, M.D., Phys. and Surg. Balt. 86), M 81-4, As't Physician, City Hospital, Baltimore.
Friedenwald, Julius (Balt. C.C.), C 84-5, M 85-6, Baltimore.
Friese, Philip Henry (Balt. C.C. 72), S 83-4, Tutor, Balt. City College.
Frost, Oscar James (B.M.E. Wis. 82, M.E. Wis. 85), G 85-6, Chemist, Argo, Colo.
Frothingham, Arthur Lincoln, Jr. (Ph.D. Leipsic 83), F 82-5, F by C 85-6, Baltimore.

Gale, Harry Edwin (A.B. Md. Ag. Coll. 81, M.D. Univ. Md. 84), G 81-2, Physician, Baltimore.
Gantt, Henry (M.D. Univ. Md.), S 78-9, Baltimore.
Gantt, Henry Laurence (A.B. 80, M.E. Stevens Inst. 84), C 78-9, M 79-80, G S 80, Mechanical Engineer, Baltimore.
Gardner, Henry Brayton (A.B. Brown 84), G 84-6, Providence, R.I.
Gardner, William, Jr. (A.B. Ill. Coll. 84), G 84-5, Greencastle, Iowa.
Garman, Harrison, S 81-2, C Z L 83, Normal, Ill.
Garner, Samuel (A.B. St. John's 71, Ph.D. 81), G 76-81, Prof. Mod. Lang. Indiana Univ. Bloomington.
Garthe, Louis (Balt. C.C. 80, A.B. 82), M 80-2, G 82-3, Baltimore.
Gates, William Epley, S 82-4, M 84-6, Philadelphia, Pa.
Gatewood, Robert Woodland (U.S.N. Acad. 84), G 84-6, Norfolk, Va.
Gavin, Frank Denton (M.D. Univ. Md. 74), G 76-7, 78-80, Physician, Baltimore.
Gephart, George Frederick (Balt. C.C., LL.B. Univ. Md. 82), S 78-81, Att'y at Law, Baltimore.
Gerber, Adolph (Ph.D. Munich 82), F by C 83-6, Prof. (elect) Mod. Lang. Earlham Coll. Richmond, Ind
Gerke, Walter Duncan, S 79-81, Baltimore.
Gieske, Gustav Edward, S 85-6, Catonsville, Md.
Giffin, Charles M. (B.L. Cincin. 71, A.M. Wesl. 75), G 77-9, Clergyman M.P. Church.
Gilbert, Philip C., C 82-4, * *Sept.* 1884.
Gildersleeve, Raleigh Colston, M and H H S 85-6, Baltimore.
Giles, Arthur Henry (A.B. Syracuse 78), G 81-2, Manlius, N.Y.
Gillespie, John Hamilton (A.B. Rutgers 82, New Brunsw. Theol. Sem.), G 82-3, Pastor, Dutch Ref. Church, New Hurley, N.Y.
Gilman, Benjamin Ives (A.B. Wms. 72, A.M. Wms. 80), G 79-81, F 81-2, F by C 82-3, New York City.
Gilpin, Joseph Elliott, C 84-5, M 85-6, Baltimore.
Gittings, David Sterrett (A.B. 83), C 78-80, M 80-3, Student of Law, Baltimore.
Gjellum, Erik Simon (A.B. Norw. Luth. 79, LL.B. Iowa Univ. 82), G 79-81, Att'y at Law, Albert Lea, Minn.
Glenn, John, Jr (A.B. 85), M 80, 81-5, G 85-6, Student of Law, Univ. Md., Baltimore.
Glenn, John Mark (A.M. Wash. and Lee 79, LL.B. Univ. Md. 82), G 79-80, Att'y at Law, Baltimore.
Glenn, William Lindsay (A.B. 84), M 80-4, G S 84-5, Student of Law, Univ. Md., Baltimore.
Goldsborough, Brice Worthington (M.D. Univ. Va. 80), S 79-80, G 80-1, Baltimore.
Geoch, George Willis (A.B. Yadkin 81), G 85-6, Henderson, N.C.
Goodman, Edgar (Balt. C.C. 75, A.B. 80, LL.B. Univ. Md. 81), C 77-8, M 78-80, G 80-5, Att'y at Law, Baltimore.
Goodnow, Henry Root (A.B. Amh. 78), G 80-2, F 82-3, F by C 83-4, Instr. Hill Sch. Pottstown, Pa., 1884-5, Brooklyn, N.Y.
Gordon, Basil Brown, M 80-4, Baltimore.
Gordon, Douglas Huntley, C 84-5, M 85-6, Baltimore.

Gore, Joshua Walker (C. E. Univ. Va. 75), F 76-8, Prof. Nat. Sci. S. W. Bapt. Univ. 78-81, As't Prof. Math. Univ. Va. 81-2, Prof. Nat. Philos. and Engin. Univ. N. C. Chapel Hill.
Gorton, William Curns Lawrence (Balt. C. C. 83), M and H H S 83-6, Baltimore.
Gould, Elgin Ralston Lovell (A. B. Victoria, Ont. 81), G 81-2, F 82-4, F by C 84-6, Instr. High School, Washington, D. C.
Grammer, Carl Eckhardt (Balt. C. C., A. B. 80, B. D. Va. Theol. Sem. 81), C 76-7, M 77-80, G 80, Student of Law, Univ. Md. 80-1, Clergyman, P. E. Church, Hancock, Md.
Grammer, Frederick Louis, S 84-5, Student Lehigh Univ. Pa.
Grape, Jacob, Jr. (Balt. C. C. 78), S 83-5, Teacher, Baltimore.
Graves, William Samuel (A. M. Wash. & Lee 69, B. L. Wash. & Lee 72), G 83-5, F by C 85-6, Prof. Greek and German, Davidson College, N. C.
Gregg, Maurice, S 81-3, Student of Law, Baltimore.
Grier, Mark Brown (A. B. Erskine 85), G 85-6. Due West, S. C.
Gross, Alfred Hermann (A. B. Toronto, 82), G 84-5, Student of Law, Chicago, Ill.
Guard, William John, M 81-3, Baltimore.
Guggenheimer, Jay Caesar, M 84-6, H H S 84-5, Baltimore.

Hahn, Harry Wolf, S 84-5, C 85-6, Chicago, Ill.
Haight, Milton (A. B. Toronto 84), G S 85-6, Pine Orchard, Ont.
Haldeman, George Bowman (A. B. Beloit 83), G 83-6, C Z L 85, Cedarville, Ill.
Hall, Clayton Coleman, G 82-5, Baltimore
Hall, Edwin Herbert (A. B. Bowdoin 75, Ph. D. 80), G 77-8, F 78-80. As't Physics, 80-1, Instr. Physics, Harvard Univ.
Hall, John Leslie, S 85-6, Richmond, Va.
Hall, Lyman Beecher (A.B. Amh. 73, Ph. D. Gött. 75), G 76-7, F 77-9, As't Chem. 79-80, Prof. Chemistry and Phys., Haverford Coll., Pa.
Halsted, George Bruce (A. B. Princ. 75, A M. Princ. 78, Ph.D. 79), Fellow of Princ. 75-6, F 76-8, Tutor and Instr. Math. Princ. 78-84, Prof. Math. Univ. Texas, Austin.
Hamilton, William Everard, Jr., S 85-6, Shreveport, La.
Hammond, Gilbert Romine (A. B. Union Chris. Coll. 76, A. M. Union Chris. 79), G 85-6, Prof. Latin, Antioch Coll. Yellow Springs, O.
Hammond, Kensey Johns (A. B. Hamp. Sid. 78, B. D. Va. Theol. Sem. 82), G 78-9, Clergyman P. E. Church, W. Va.
Hanner, James Garland (A. B. Marietta 81), G 81-2, Union Theol. Sem. 82-5, Parkersburg, W. Va.
Hanna, Albert Armstrong (M. D. Univ. Md 75), G 83-5, Physician, Baltimore.
Hanser, Otto Franz Theodore (Concordia 78), G 81-2, Minister German Lutheran Church, New York City.
Harding, Caleb Richmond (A. B. Davids. 80, A. M. Davids. 85), Prof. Greek, Hamp. Sidney, 83-5, G 80-1, 82-3, 85-6, Graham, N. C.
Harding, Edward Coles (A. M. Univ. Va. 76), F 78-9, Student of Law, Univ. Va. 76-7, Classical Instr. Balt. 77-8 and N. Y. City 80-1, Prof. Greek, Univ. La. 79-80, Baltimore.
Harlan, William Beatty (A. B. 83, LL. B. Univ. Md. 85), C 79-81, S 81-2, M 82-3, Att'y at Law, Belair, Md.
Harrison, Graeme (A B. Princ. 81, A. M. Princ. 84, LL. B. Univ. Md. 84), G 81-2, 84-5, Baltimore.
Harrison, William G. (M. D. Bellevue 64), G 76-7, Physician, Baltimore.
Harry, Joseph Edward, M 83-6, H S 85-6, Pylesville, Md.
Hart, Edward (S. B. Lafay. 74, Ph. D. 79), F 76-8, Prof. Analyt. Chem. Lafayette Coll. Easton, Pa.
Hartogensis, Benjamin Henry (Balt. C. C. 83), M 83-6, Baltimore.
Hartwell, Edward Mussey (A. B Amh. 73, A. M. Amh. 76, Ph. D. 81, M. D. Miami Med. Coll. 82), Instr. Boston Latin Sch. 74-7, G 78-9, F 79-81, Physician, Cincinnati 82-3, Instr. 83-4. and A. Physical Training 84-, Baltimore.
Hathaway, Arthur Stafford (S. B. Corn. 79), G 79-82, F 82-4. F by C 84-5, Instr. Math. Cornell Univ. Ithaca, N. Y.
Haworth, Erasmus (S. B. Kans. Univ. 81), G 81-2, Prof. Chem. Penn Coll. Oskaloosa, Ia.
Hay, Jesse. C 77-9. Baltimore.
Hayes, Charles Willard (A. B. Oberlin 83), G 84-5, G S 85-6. Hanover, O.
Haynes, Elwood (B. S. Worc. Free Inst. 81), G 84-5, Instr. Normal School, Portland, Ind.
Hedrick, William Adam (A. M. Columbian 84), G 84-6, Georgetown, D. C.
Helfenstein, Edward Trail, S 85-6, Frederick, Md.
Hemmeter, John Cohn (Balt. C. C., M. D. Univ. Md. 83), G 84-6, C Z L 85, Baltimore.
Hemphill, Charles Robert (S. C. Univ. 69, Va. Univ. 71, S. Presb. Theol. Sem., A. M. Davids. 78), F 78-9, Prof. S. W. Presb. Univ. 79-82, A. Prof. Southern Theol. Sem. 82-5, Clergyman, Presb. Church, Louisville, Ky.
Hench, George Allisen (A. B. Lafay. 85), G 85-6, Carlisle, Pa.
Henderson, Raymond Lee, S 85-6, Hancock, Md.
Hering, Daniel Webster (Ph. B. Yale 72, C.E. Yale 78), R. R. Engineer 73-4, 78-80, F 76-8, Prof. Math. W. Md. Coll. 80-4, West. Univ. of Pa. 84-5, Prof. Physics, Univ. City of New York.
Herrick, Francis Hobart (A. B. Dartm. 81), G 84-6, C Z L 85, Tilton, N. H.
Hilles, William Sadler, C 85-6, Baltimore.
Hillyer, Homer Winthrop (S. B. Wis. 82, Ph. D. 85), G 82-3, G S 83-4, F 84-5, As't Chem. Univ. of Wisconsin, Madison, Wis.
Hinkley, John (A. B. 84), M 81-4, Student of Law, Univ. Md., Baltimore.
Hitchcock, George Gale (A. B. Neb. Univ. 83), G 84-5, Instr. Nat. Sci. and Math. Pierre Univ. Dakota.
Hixson, Hiram Franklin (Ph. B. Ashland 81, Ph. D. Ashland 83), Pres't Ashland Coll. 83-5. G 85-6, Ashland, O.
Hobbs, William Herbert (B. S. Worc. Free Inst. 83), G 84-6, Auburn, Mass.
Hobson, Benjamin Lewis (A. B. Central Univ. Ky 77, A. M. Central 80), G 81-2, Lexington, Mo.
Hodge, Clifton Fremont (A. B. Ripon 82), G 85-6, Ripon, Wis.
Hodges, James Shaler, C 83-4, M 84-6, Baltimore.
Hodges, Sebastian, C 79-80, Baltimore.
Hoen, Albert Bartholomew, S 85-6, Waverly, Md.
Hoffmann, Otto, C 84-5, M 85-6, New Yurk City.
Holcomb, William Penn (B. L. Swarthmore 78, M. L. Swarth. 81), G 83-6, Prof. (elect) Hist. & Pol. Science, Swarthmore Coll., Pa.
Holmes, Jesse Herman (S. B. Neb. Univ. 84), G 85-6, Lincoln, Neb.
Holstad, Andrew (A. B. Norw. Luth. 81), G 81-3, San Francisco, Cal.
Horner, Junius Moore (A. B. 85), M and H H S 83-5, G S 85-6, Teacher, Oxford, N.C.
Hough, Theodore, M 83-6, H H S 84-5, Baltimore.
Howard, Curtis Clark (S. B. State Univ. O. 78), G 79-80, Physician, Columbus, O.
Howard, Charles Howard (A. B. 84), M 82-4, G 84-5, G S 85, Student of Law, Univ. Md., Baltimore.
Howe, Charles Sumner (B. S. Mass. Ag. Coll. 78), G 82-3, Prof. Math. Buchtel Coll., Akron, O.
Howell, Edwin Clarence (A. B. Harv. 83), G 83-4, Teacher of Math., Baltimore.
Howell, William Henry (Balt. C. C., A. B. 81, Ph. D. 84), M 79-81, G S 81-2, F 82-4, As't 84-5, C Z L 85, A in Biology 85-6, Baltimore.
Hubbard, Frank Gaylord (A. B. Wms. 80), G 84-6, Oswego, N. Y.
Hudgins, Maxwell S. (C. E. Wash. and Lee 76), G 76-7, Instr. Cooper Inst. N. Y.
Huggins, Hudley Murray, C 81-3, Baltimore.
Hughes, John Samuel (Balt. C. C.), S 83-4, Student of Law, Baltimore.
Hughes, Percy Meredith, C 84-5, M and W S 85-6, Washington, D. C.
Hulzinga, Abel Henry (A. B. Hope 80, A. M. Hope 83, New Brunswick Theol. Sem.), G 83-4, F 84-6, Zeeland, Mich.
Hussey, George Benjamin (A. B. Columbia 81), G 84-5, G S 85-6, East Orange, N. J.
Hussey, George Frederick, S 79-80, Baltimore.
Hyslop, John Thomas Benjamin (M. D. Univ. Md. 85), P M 81-2, Physician, Pungoteague, Va.

Iles, Malvern Wells (Ph. B. Columbia 75, Ph. D. Columbia 77), F 76-8, Chemist, Leadville, Colo.
Ingle, Edward (Balt. C. C., A. B. 82), M 79-82, G 82-4, Baltimore.
Irby, John Robin McDaniel (S. B. Univ. Va. 75, Ph. D. Gött. 78), Miller Scholar, Univ. Va. 73-5, F 79-80, * *March* 25, 1880.

Jackson, Walter Beattie, C 84-5, Marion, Va.
Jacques, William White (S. B. Mass. Inst. Tech. 76, Ph. D. 79), F 76-9, Electrician, Boston, Mass. 78-86, Instr Telegraph Eng. Mass. Inst. Tech., Boston.
Jagemann, Hans Carl Günther (Naumburg Gym. 76, Ph. D. 84), G 81-2, G S 82-3, F 83-4, Prof Mod. Lang. Earlham Coll., Richmond, Ind., 84-6, Prof. (elect) German. Univ. Ind., Bloomington.
James, Walter Belknap (A. B. Yale 79), G 79-80, Baltimore.
Jameson, John Franklin (A. B. Amh. 79, Ph. D. 82), G S 80-1, F 81-2, As't 82-3, A. in History 83-, Baltimore.
Jamieson, Alexander Fridge (A. B. 80), C 76-7, M 77-80, G 80-1, Teacher, Lawrenceville, N. J.
Janney, Oliver Edward (M. D. Univ. Md. 81 and Hahnemann Med. Coll. Phila. 82), G 85-6, Physician, Baltimore.
Jarvis, Edmund Allen (A. B. 80), C 76-7, M 77-80, G 80, * *October* 15, 1880.
Jarvis, William C. (M. D. Univ. Md. 76), G 76-7, Baltimore.
Jastrow, Joseph (A. B. Univ. Pa. 82, A. M. Pa. 85), G 82-4, G S and F 84-6, Philadelphia.
Jay, John G. (M. D. Univ. Md. 71), G 76-7, Physician, Baltimore.
Jayne, Horace Fort (A. B. Univ. Pa. 79, M. D. Pa. 82), G 83-4, Prof. Vert. Morphol. Univ. Pa., Philadelphia.
Jayne, Joseph Lee (U. S. N. Acad. 82), Ensign U. S. N., G 85-6, Brandon, Miss.
Jefferson, Howard S., S 84-5, Baltimore.
Jenkins, Felix S. (M. D. Univ. Md. 82), C 78-80, Physician, Baltimore.
Jenkins, Oliver Peebles (A. B. Moore's Hill Coll. 69, A. M. Moore's Hill, 72), G 82-3, C Z L 83, 85, Prof. Nat. Sci. Normal Sch., Terre Haute, Ind.
Johnson, John (A. B. 81), C 79-80, M 80-1, G 81-5, Instr. McDonogh Sch. Md.
Johnson, Oakley A. (B. S. Rutgers 81), G 81-2, Princ. High Sch. Westfield, N. J., 84-5, Sing Sing, N. Y.
Johnson, Robert Wilkinson (A. B. Princ. 76, M. D. Univ. Pa. 79), G 76-7, 82-3, Physician, Baltimore.
Johnston, Christopher, Jr. (A. M. Univ. Va. 79, M. D. Univ. Md. 80). G 82-3, Physician, Baltimore.
Johnston, Robert Clapham, M 82-4, Baltimore.
Jones, Charles Edgeworth (A. B. and Ph. B. Univ. Ga. 85), G 85-6, Augusta, Ga.
Jones, Charles Hampson (B. Med. and M. Surg. Edinburgh 83), S 77-9, Physician, Baltimore.
Jones, Harry Cleary, S 85-6, New London, Md.
Jones, John Carleton (A. B. Westminster Coll. Mo. 79), G 82-3, Fulton, Mo.
Jones, Joseph J. C. (Balt. C. C.), C 80-1, Baltimore.
Jones, Walter (Balt. C. C. 84), C 84-5, M 85-6, Baltimore.
Jones, William Augustine, C 84-5, M 85-6, Tuscaloosa, Ala.
Joyce, John Jay (A. B. Univ. Pa. 71, A. M. Univ. Pa. 74), G 77-8, Clergyman P. E. Church, Georgetown, D. C.

Kaessmann, Frederick D. J., C 84-5 Baltimore.
Kaiser, Aleis, S 77-9, Rabbi, Baltimore.
Kastle, Joseph Hoeing (S. B. Ky. State Coll. 84), G 84-5, G S 85-6, Lexington, Ky.
Katzenstein, Louis (Univ. Berlin), G 85-6, Baltimore.
Keeler, James Edward (A. B. 81), S 78-81, M 81, As't Allegheny Astron. Observ. 82-6, As't Lick Observ. Cal.
Keerl, E. Fraser, M 82, Student Univ. of Oxford, England.
Keilholtz, Pierre Otis (U. S. N. Acad. 84), G 84-6, Baltimore.
Keiser, Edward Harrison, (S. B. Swarth. 80, M. S. Swarth. 81, Ph. D. 84), G 81-2, F 82-4, As't 84-5, A Prof. Chemistry, Bryn Mawr Coll., Pa.
Kemp, George Theophilus (Balt. C. C., A. B. 83), M 81-3, G 83-4, G S 84-5, F 85-6, Baltimore.
Kennard, John Hansen, Jr. (Univ. La. 83), G 83-4, New Orleans, La.
Keyser, Newberry Allen Smith (M. D. Univ. Md. 83), P M 79-81, Physician, Baltimore.
Keyser, Roland S. (A. B. Syracuse 72, A. M. Syracuse 75), G 77-8, Havana, N. Y.
Kimball, Arthur Lalande (A. B. Princeton 81, Ph. D. 84), F 82-3, F by C 83-4, A Physics, 84-, Baltimore.
Kimball, Richard Fuller (A. B. 82, LL. B Univ. Md. 84), C 78-80, M 80-2, Atty. at Law, Baltimore.
Kinnicutt, Leonard P. (S. B. Mass. Inst. Tech. 75), G 78-9, Instr. Chem. Harv. 81-3, As't Prof. Chem. Worcester Free Inst., Worcester, Mass.
Knight, Herbert, P M 84-5, Lancaster, Pa.
Knight, Lewis W. (M. D. Univ. Md. 66), G 77-8, Physician, Baltimore.
Koyl, Charles Herschel (A. B. Victoria, Ont 77), G 79-80, G S 80-1, F 81-3, Instr. High School, Washington, D. C.
Kuhara, Mitsuru, (S. B. Tokio 79, Ph. D. 81), F 79-81, F by C 81-2, Lect. Organic Chem. Univ. Tokio, Japan.

Ladd, Christine [now Mrs. F. Franklin] (A. B. Vassar 69), G 78-82, Baltimore.
Lacssig, John Henry, Jr., S 82-4, C 84-6, Baltimore.
Lamb, Arthur Lincoln, C 83-4, M 84-6, Baltimore.
Lambert, Marcus Bachman, (A. B. Lafay. 82), G 84-5, Riegelsville, Pa.
Langdon, Courtney (Harvard), G 85-6, Teacher, Baltimore.
Lanier, Charles Day, C 85-6, McDonogh, Md.
Lanman, Charles Rockwell (A. B. Yale 71, Ph. D. Yale 73), F 76-7, A 77-80, Prof. Sanskrit, Harvard Univ.
Lauer, Martin (Balt. C. C. 75), S 76-7, Baltimore.
Lawrie, Andrew Davis (A. B. Amh. 73, Ph. D. Gött. 76), G 76-7, Boston, Mass.
Lawson, Andrew Cooper (A. B. Toronto 83, A. M. Toronto 85), G 85-6, Geol. Survey of Canada, Ottawa.
Learned, Marion Dexter (A. B. Dickinson 80, A. M. Dickins. 83), G 84-5, F 85-6, Dover, Del.
Lee, Frederic Schiller, (A. B. St. Lawr. Univ. 78, A. M. St. Lawr. 80, Ph. D. 85), G 81-3, C Z L 83, G S 83-4, F 84-5, Student of Biology, Leipsic, Germany.
Lee, William (M. D. Univ. Md. 64), G 76-7, Physician, Baltimore.
Leftwich, Thomas James, C 79-82, Atty. at Law, Minneapolis, Minn.
Lehmann, Ferdinand Friedrich Carl (LL. D. Gött. 83), G 83-4, Hamburg, Germany.
Leonard, Benjamin F. (M. D. Univ. Md. 76), G 77-80, Physician, Baltimore.
Lerch, Charles Henry (A. B. Lafay. 82), G 84-5, Teacher, Easton, Pa.
Lester, Samuel T., S 76-7, Teacher, Baltimore.
Le Van Bender, John, S 80-1, Physician, Penn Yan, N. Y.
Levermore, Charles Herbert (A. B. Yale 79), G 83-4, F 84-5, Teacher, New Haven, Conn.
Lewis, Henry Carvill (A. M. Univ. Pa.), F by C 84-5, Prof. Mineral. Phila. Acad, Nat. Sci., Prof. Geol. Haverford College, Pa.
Lewis, John Shackelford (M. D. Phys. and Surg. Balt. 79). G 79-80, Physician, Baltimore.
Lewis, Thomas Hamilton (A. B. West. Md. 75, A. M. West. Md. 78), G 77-9, Minister M. E. Church, Prest. West. Md. College, Westminster, Md.
Lichty, William Henry (B. L. Neb. Univ. 84), G 84-5, Tecumseh, Neb.
Liebig, Gustav Adolph, Jr. (A. B. 82, Ph. D. 85), M 79-82, G S 82-3, F 83-5, F by C 85-6, Baltimore.
Liebig, Rudolph Aloysius, M 81-3, Baltimore.
Linn, Alvin Frank (A. B. Wittenberg, 84), G 85-6, Springfield, O.
Linthicum, Stewart Brian (A. B. 80, LL. B. Univ. Md. 82), M 77-80, G 80-3, Att'y at Law, Portland, Oregon.
Loane, James Albert (Balt. C. C. 82, A. B. 85), M 82-5, G S 85, Baltimore.
Lockwood, William F. (M. D. Univ. Va. 75), G 80-1, Physician, Baltimore.
Lodge, Gonzalez (Balt. C. C. 81, A. B. 83), M 81-3, G S 83-5, F 85-6, Baltimore.
Loeb, Albert Henry, C 85-6, Chicago, Ill.
Lord, John Deering, Jr. (A. B. 84), M 81-4, Student of Law, Columbia College, New York.
Lord, Jere Williams (A. B. 84), P M 81-4, M 84, Student of Med. Univ. of Pa, Philadelphia.
Loudon, William James (A. B. Toronto 80), G 81-2, Toronto, Ontario.
Love, James Lee (Ph. B. Univ. N. C. 84), G 84-5, As't Prof. Math. Univ. of N. C., Chapel Hill.
Lowe, John Hanson (Balt. C. C., A. B. 80, LL. B. Univ. Md. 82), M 77-80, G 81-2, Att'y at Law, Baltimore.
Lowndes, Charles N. T., P M 84-5, Student of Med. Univ. Md. Baltimore.
Lowry, William Scott (S. C. Theol. Sem.), G 84-5, Smithville, Va.
Lupton, Silas Lucien, C 76-7, Winchester, Va.
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Mauck, Joseph William (A. B. Hillsdale 75), G 79-80, Prof. Hillsdale Coll., Mich.
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McCormick, Thomas P. (M. D. Univ. Md. 77), G 77-8, Physician, Baltimore.
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McIntosh, James Higgins (A. B. Newberry 84), G 84-6, Newberry, S. C.
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Morris, Henry Heyward, C 84, * *Oct.* 28, 1884.
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Osborn, Henry Leslie (A. B. Wesl. 78, Ph. D. 84), F 81-2, F by C 82-4, C Z L 82, 83, 84, Prof. Zool. Purdue Univ. Lafayette, Ind.
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Page, James (Balt. C. C., A. B. 82), M 79-82, G 82-4, Mass. Inst. Tech. 84-5, Baltimore.
Page, Walter Hines (Rand. Macon 76), F 76-8, Lect. N. C. Normal Coll. 78, Prof. Louisville High Sch. 78-9, Journalist, Raleigh, N. C.
Painter, Charles, C 76-7, * *Dec.* 1877.
Palmer, Albert Gallatin (A. B. 82, Ph. D. 85), C 79-80, M 80-2, G 82-3, G S 83-4, F 84-5, As't in Chem. Swarthmore Coll. Pa.
Palmer, Chase (A. B. 79, Ph. D. 82), C 76-7, M 77-9, G S 79-80, F 80-2, As't in Chem. Mass. Inst. of Tech. 82-3, Prof. Chem. State Normal School, Salem, Mass.
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Patterson, James Wilson (A. B. Princ. 63), G 80-1, Baltimore.
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Poinier, Peter Porter (M. E. Stevens 74), F 76, * *June*, 1876.
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Randall, Wyatt William (A. B. St. John's 84), G 85-6, Annapolis, Md.
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Reeve, James Spofford (A. B. Lawr. Univ. Wis. 85), G 85-6, Appleton, Wis.
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Reid, Harry Fielding (A. B. 80, Ph. D. 85), C 77-8, M 78-80, G S 80-1, G 81-2, F 82, As't in Physics 82-4, Student in Cambridge, Eng.
Rice, Henry Joseph (S. B. Corn. 76, M. S. Corn. 80, Sc. D. Syracuse 81), F 76-8, C Z L 79, 81, As't U. S. Fish Commission 79, Prof. Mich. Mil Acad. 80-2, Prof. Nat. Sci. Brooklyn N. Y. High Sch. 82-5, * *Dec.* 13, 1885.
Rich, Alexander Miller (A. B. Hobart 85), S 82-3, Teacher, Reisterstown, Md.
Rich, Edson Prosper (B. L. Neb. Univ. 83), G 83-4, Student of Law, Lincoln, Neb.
Rich, Jacob Monroe (M. E. Columbia 83, C. E. Columb. 84), G 85-6, New York City.
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Robinson, Carvel Hall, M 80-1, * *July* 25, 1882.
Robinson, Lewis Bayard (Balt. C. C.), C 81-2, Baltimore.
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Sedgwick, William Thompson (Ph. B. Yale 77, Ph. D. 81), Yale Med. Sch. 77-8, Instr. Yale 78-9, F 79-80, As't 80-1, A in Biology 81-3, As't Prof. Biology, Mass Inst. Tech. Boston.
Seelye, William James (A. B. Amh. 79), G 80-1, Instructor, Lawrenceville School, N. J.
Sewall, Henry (S. B. Wesl. 76, Ph. D. 79), G 76-8, F 78-9, A in Biology, 80-2, Prof. Physiology, Univ Mich. Ann Arbor.
Sewall, William Dunning (B. S. Worc. Free Inst. 82), G 82-3, Bath, Me.
Sharp, George Matthews (LL. B. Yale 75). G 77-8, Atty. at Law, Baltimore.
Shaw, Albert (A. B. Iowa 79, A. M. Iowa 82, Ph. D. 84), G 81-2, G S 83-4, Editor "Tribune," Minneapolis, Minn.
Shearer, Thomas Laidlaw (M. B. and M. of Surg., Edinb. 82), S 77-8, Physician, Baltimore.
Sheffoe, Joseph Samuel (A. B. Norw. Luth. 85), G 85-6, Waukon, Iowa.
Shenwell, Joseph Freeland, P M 84-6, Prince Frederick, Md.
Shinn, Charles Howard (A. B. 84), S 82-4, San Francisco, Cal.
Shippen, Charles Carroll (A. B. Harv. 77, M. D. Univ. Md. 79), G 77-8, 80-1, Physician, Baltimore.
Short, Henry Alford (A. B. Columbia 80, Ph. D. 85), F Columbia 80-3, F by C 80-5, As't in Latin, Columbia Coll., New York.
Sieber, John (Balt. C. C., A. B. German-Wallace Coll. O. 81), G 81-3, Student, Drew Theol. Sem., Madison, N. J.
Sibler, Christian (Concordia 66, M. D. Univ. Mich. 71, Ph. D. 81), F 77-9, C Z L 78, 79, As't Biol. 79-80, Physician, Cleveland, O.
Sibler, Ernest Gottlieb (Concordia 69, Ph. D. 78), F 76-9, Classical Instructor, New York City.
Simon, Charles Edmund, M and H S 85-6, Baltimore.
Simpson, Shadrach (A. B. Trinity, N. C. 73, A. M. Trinity 75), G 83-5, Prof. Chem. West Md. Coll., Westminster, Md.
Slack, Henry Richmond, Jr. (Ph. G. Md. Coll. Pharmacy 85), S 83-5, La Grange, Ga.
Slaughter, Moses (A. B. Ind. Asbury 83), G 83-4, G S 84-5, F 85-6, Brooklyn, Ind.
Sloan, Robert Neal (A. B. Georgetown 85), G 85-6, Baltimore.
Smedes, Evert Bancker (A. B. Univ. N. C. 83), G 83-4, Raleigh, N. C.
Smith, Arthur Donaldson (A. B. Univ. Pa. 85), G 85-6, Philadelphia, Pa.
Smith, Augustine Jaequeline, S 78-9, Clergyman P. E. Church, Calverton, Md.
Smith, Anthony M., S 77-8, Baltimore.
Smith, Charles Lee (S. B. Wake Forest 84), G 85-6, Raleigh, N. C.
Smith, George La Tour (C. E. Corn. 74), G 76-7, 83-4, Teacher, State Normal Sch. Baltimore.
Smith, Kirby Williams, (A. B. Univ. Vt. 84), G 85-6, Rutland, Vt.
Smith, Nathan Ryno, P M 82-3, Student of Med. Univ. Md. Baltimore.
Smith, Theobald (Ph. B. Corn. 81), G 81-2, Albany, N. Y.
Smith, William Flood (Balt. C. C. 83), M and H H S 83-6, Baltimore.
Smyth, Albert Henry (A. B. Phila. Central High Sch. 82), G 85-6, Philadelphia, Pa.
Smyth, Herbert Weir (A. B. Harv. 78, Ph. D. Gött. 84), Instr. Wms. Coll. 83-5, F by C 85-6, Baltimore.
Southworth, Mase Shepard (Ph. D. Tübingen 73), Prof. Chem. Wms. Coll. 76-82, F by C 80-1, 85-6, Springfield, Mass.
Spicker, Edward Henry (Balt. C. C. 77, A. B. 79. Ph. D. 82), M 77-9, G S 79-80, F 80-2, Instr. Greek and Latin, 82-, Baltimore.
Sprigg, Alldin M., C 76-7, M 77-8, Cumberland, Md.
Stahler, Augustus (M. D. Howard Univ. 83), C 76-8, Physician German Hosp. Phila. 83-4, Brighton, Md.
Stamps, Preston (Ph. B. Univ. N. C. 83), G 83-4, Milton, N. C.
Stebbins, Frank Edward (A. B. Amh. 80), G 80-1, Springfield, Mass.
Steel, William Black (A. B Lafay. 79, A. M. Lafay. 82), G 83-4, Port Deposit, Md.
Steele, Robert Benson (A. B. Univ. Wis. 83), G 85-6, Lodi, Wis.
Steele, Samuel Tagart, S 83-4, Baltimore.
Steigner, George E. de (A. B. Ohio Univ. 84), G 84-5, Athens, O.
Stein, Michael Daniel, S 83-5, M 85-6, Oakland, Cal.
Steiner, Hugo (Balt. C. C., A. B. 85), M 82-5, G 85-6, Baltimore.
Stephenson, Wiley Roy, C and M 76-7, Stephenson's Depot, Va.
Sternberg, George M. (M. D. Phys. and Surg. N. Y. 60), Surgeon U. S. A., F by C 80-1, 84-6, Baltimore.
Stetson, Carlton Beecher (A. B. Colby 81, A. M. Colby 85), G 85-6, West Sumner, Me.
Steuart, Arthur (Balt. C. C., LL. B. Univ. Md. 80), S 76-8, Att'y at Law, Baltimore.
Stevens, Lewis Tebbetts (Balt. C. C., A. B. 82), M 79-82, G S 82-3, F 83-4, Student, Harvard Med. Sch. Boston, Mass.
Stevens, Morris Putnam (Balt. C. C.), S 84-6, Baltimore.
Stickney, Charles Dickinson, Jr., S 81-2, New Bedford, Mass.
Stokes, George Clement, Jr. (A. B. 84), M 81-4, G 84-5, Student of Law, Univ. Md., Govanstown, Md.
Stokes, Henry Newlin (S. B. Haverf. 78, Ph. D. 84), G 78-80, G S 80-81, F 81-3, F by C 83-4, Student of Chem. in Munich, Germany.
Stoller, James (A. B. Union 84), G 84-5, Johnstown, N. Y.
Stout, James Edloe (Univ. Va. 69), G 82-4, Louisa Co. Va.
Stow, Audley Hart (Balt. C. C.), P M 83-6, Baltimore.
Stratton, William Edgar (Balt. C. C., A. B. 83), P M 80-2, M 82-3, Student, Harv. Med. Sch. Boston, Mass.
Straus, Irvin J., P M 84-5, S 85-6, Baltimore.
Stricklen, Wiltz Raymond (Balt. C. C. 76, A. B. 80), C 76-7, M 77-80, Minister M. E. Church, Baltimore.
Stringham, Washington Irving (A. B. Harv. 77, Ph. D. 80), G 77-8, F 78-80, Parker F of Harv. 80-2, Prof. Math. Univ. Cal. Berkeley.
Strobel, William, S 76-8, Minister Lutheran Church, Baltimore.
Sudduth, Hugh Thomas (A. M. Muskingum 81). G 82-3, Prof. Rhetoric and Eng. Lit. Ohio Univ., Athens, O.
Sutro, Alfred Emil, C 79-80, Baltimore.
Swann, Edward, S 82-3, Student of Law, Columbia Coll., N. Y.
Swartz, Charles Kephart, S 84-6, Gettysburg, Pa.
Sweet, Wright I. (C. E. Union 80), G 82-3, Dean's Corners, N. Y.
Swift, Morrison Isaac (A. B. Wms. 79, Ph. D. 85), G 79-80, F 80-2, F by C 82-3, 84-5, Instr. Philos. Hobart Coll. 82-4, Student in Berlin, Germany.
Szold, Benjamin, S 76-7, Rabbi, Baltimore.

Taber, Henry (Ph. B. Yale 82), G 82-5, New York City.
Talmage, James Edward, S 83-4, Teacher, Provo City, Utah.
Tarleton, Robert Melvin, M 85-6, Baltimore.
Tatlock, Seymour Whitman, S 83-4, Hoosick Falls, N. Y.
Taylor, Amzi Dodd, S 80-1, Newark, N. J.
Taylor, Frederick Manville (A. B. Northwestern, Ill. 76, A. M., N. W. 79), G 84-5, Prof. History, Albion College, Albion, Mich.
Taylor, Frank Wilhelm, C 85-6, Baltimore.
Taylor, John Phelps (A. B. Yale 62, A. M. Yale 67), F by C 85-6, Prof. Andover Theol. Sem., Andover, Mass.
Taylor, Percy Hayes, S 80-3, Student, Harvard Coll. Cambridge, Mass.
Taylor, Robert Tunstall, M 85-6, Baltimore.
Taylor, William Dana (B. E. Ala. Agric. 81), G 84-5, Auburn, Ala.
Thach, Charles Coleman (B. E. Ala. Agric. 77), G 80-1, Teacher, Sherman, Texas.
Thayer, William Cleveland (A. B. Columbia 76), G S 81-2, F by C 83-4, Prof. Math. Hobart Coll. 82-3, Teacher, Jacksonville, Fla.
Thomas, Bond Valentine (A. B. Haverf. 83), G 83-4, Baltimore.
Thomas, Henry Mifflin (M. D. Univ. Md. 85), P M 79-84, Physician, Baltimore.
Thomas, Richard Henry (M. D. Univ. Md. 75), G 76-7, 79-80, Physician, Baltimore.
Thomas, William Jones (A. B. 84), C 76-7, M 77-80, S 82-4, Prof. Math. West. Md. Coll. 84-5, **March* 9, 1885.
Thompson, Henry Oliver, M 84-6, Baltimore.
Tidball, Charles Martin, S 80-1, Minister, Presbyterian Church, Greensboro, N. C.
Tidball, William Jared (A. B. Davids. 78), G 79-81, Greenshoro, N. C.
Tiernan, Charles B., S 77-8, Att'y at Law, Baltimore.
Tiffany, Herbert Thorndyke (A. B. 82, LL. B. Univ. Md. 85), M 79-82, G 82-3, Att'y at Law, Baltimore.
Tolman, Albert Harris (A. B. Wms. 77), G 82-3, G S 83-4, F 84, Prof. Rhetoric and English Lit. Ripon Coll., Ripon, Wis.
Torrison, Isaac Berthinius (A. B., Norw. Luther 79, Concordia Theol. Sem. 83), G 79-80, Minister, Lutheran Church, Manitowoc, Wis.
Trail, Henry (A. B. Harv. 84), G 84-5. Frederick, Md.
Treadwell, William Hearle (Ph. D. Heidelb. 80), G 80-1, Instr. in French Yale 82-3, Minneapolis, Minn.
Trimble, Isaac Ridgway, Jr. (M. D. Univ. Md. 84), P M 79-82, Physician, Longwood, Md.
Trower, Thomas Lyttleton, Jr., C 84-5, **July*, 1885.
Trueman, James Starr (A. B. Dalhousie 82), G 85-6, St. John, New Brunswick.
Turner, George Mortimer (S. B. Amh. 85), G 85-6, Skaneateles, N. Y.
Tuska, Benjamin Simon William, C 84-5, M 85-6, New York City.
Tuttle, Albert Henry (B. S. Pa. State Coll. 68), F by C 82-3, C Z L 83, Prof. Zoology, Ohio State Univ. Columbus.
Tyler, Joseph Henry (A. B. Brown 77), G 77-9, Baltimore.
Tyson, Isaac, Jr., S 84-5, Baltimore.
Tyson, James W., Jr., S 84-5, Baltimore.

Uhler, John R. (M. D. Univ. Md. 61), G 76-7, Physician, Baltimore.

Van Meter, William Kendrick, (A. B. Ham. 85), S 84-5, New York City.
Van Velzer, Charles Ambrose (S. B. Corn. 76), F 78-81, As't Prof. Math. Univ. Wis. Madison.
Van Vleck, Edward Burr (A. B. Wesl. 84), G 85-6, Middletown, Conn.
Van Vleck, Frank (M. E. Stevens Inst. 84), G 84-5, Instr. Graphics and Kinematics, Cornell Univ. Ithaca, N. Y.
Van Vorst, Frederick Boyd (A. B. Princ. 75), F, Princ. 75-6, F 76-7, Att'y at Law, New York City.
Veblen, Andrew Anderson (A. B. Carleton 77, A. M. Carleton 80), G 81-3, As't Prof. Math. State Univ., Iowa City, Iowa.
Veblen, Thorstein Bunde (A. B. Carleton 80), G 81-2, Northfield, Minn.
Veneziani, Carlo (Ph. D. Heidelb. 83), G 84-5, Teacher, Boston, Mass.
Vincent, John Martin (A. B. Oberlin 83), G 85-6, Elyria, O.
Voorhees, Herman (C. E. Renss. Polyt. Inst. 73), G 78-9, F 79, **October* 14, 1879.

Waller, Charles De Vane (A. B. Erskine 83), G 83-4, Selma, Ala.
Wallis, Samuel (A. B. Georgetown, 84), G 84-6, New Orleans, La.
Waltemeyer, John Tassey, P M 83-4, Atchison, Kan.
Walz, William Ferdinand (Balt. C. C. 81, A. B. 84), S 81-4, M 84, G 84-6. Baltimore.
Warfield, Mactier (A. B. 81, M. D. Univ. Md. 84), C 76-7, M 77-81, G 81-2, Physician, Baltimore.
Warner, Amos Griswold (B. L. Univ. Neb. 85), G 85-6, Roca, Neb.
Warner, Anthony Kimmel (Balt. C. C., M. D. Univ. Md. 85), S 83-4, Physician, Baltimore.
Warner, Clarence Duane (B. S. Mass. Agric. 81), G 83-4, Granby, Mass.
Warren, Frederick Morris (A. B. Amh. 80), G 83-4, Durham, Me.
Warren, Henry Clarke (A. B. Harv. 79), G 79-84, Boston, Mass.
Warren, Horatio Alanson, C 85-6, Collinsville, Conn.
Watson, Edward Lionel (Balt. C. C. 79), S 79-80, Minister M. E. Church, Baltimore.
Webb, William Rollins (A. M. Trinity 78), G 82-3, Clergyman P. E. Church, Baltimore.
Webster, Albert Lowry (Ph. B. Yale 79), Topographer U. S. Geol. Surv. 80-3, F by C 83-4, Sanitary Engineer, West New Brighton, Staten Island.
Weech, Robert William Henry (Balt. C. C.), C 84-6, Baltimore.
Weidner, Revere F. (A. B. Muhlenberg 69, A. M. Muhlb. 72), G 77-8, Minister Lutheran Church, Phillipsburg, N. J.
Wells, Benjamin Willis (A. B. Harv. 77, Ph. D. Harv. 80), F 81, Instr. in English, Friends' School, Providence, R. I.
Wheeler, Arthur Wilson (A. B. Amh. 79), G 79-80, F 80-1, **Jan.* 6, 1881.
Wheeler, John Henry (A. B. Harv. 71, A. M. Harv. 75, Ph. D. Bonn 79), F 76-7, F and Tutor in Latin, Harvard 77-81, Prof. Latin, Bowdoin 81-2, Prof. Greek, Univ. Va.
Whetham, Charles (A. B. Toronto 84, A. M. Toronto 85), F 85-6, Dundas, Ont.
Whicher, George Meason (A. B. Iowa 82), G 84-5, Prof. Greek, Hastinga Coll., Hastings, Neb.
White, Edward Lucas, M and H H S 84-6, Baltimore.
White, John, Jr., S 84-5, C 85-6, Poolesville, Md.
Whitelock, George (LL. B. Univ. Md.), S 76-8, Att'y at Law, Baltimore.
Whiting, Guy Fairfax (M. D. Univ. Md. 78), G 79-81, Physician, Baltimore.
Whitman, Charles Otis (A. B. Bowd. 68, A. M. Bowd. 71, Ph. D. Leips. 78), F 79, Prof. Zool. Univ. Tokio 79-81, As't in Zool. Mus. Comp. Zool., Cambridge, Mass.
Whitman, Frank Perkins (A. B. Brown 74), G 79-80, Prof. of Physics, Renss. Polytech. Inst., Troy, N. Y.
Whitney, Milton, Jr., S 79-80, Waterbury, Md.
Whitridge, James Barney, S 78-9, Baltimore.
Wiegand, Henry Hazlehurst (Balt. C. C., A. B. 85), S 80-5, M 85, G 85-6, Baltimore.
Wiesenfeld, Bernard (Balt. C. C. 74), M 84-6, Baltimore.
Wiggins, Benjamin Lawton (A. B. Univ. of South 80, A. M. Univ. of South 82), F by C 82-4, Prof. Anc. Lang., Univ. of the South, Sewanee, Tenn.
Wightman, Arthur Clarence (A. B. Wofford 79), G 84-6, Marion, S. C.
Wightman, John Roaf (A. B. Toronto 71, A. M. Toronto 72), G S 85-6, Toronto, Ont.
Wilburn, B. R., S 78-9, Clergyman Meth. Church, Baltimore.
Wilcox, Alexander Martin (A. B. Yale 77, Ph. D. Yale 80), Amer. School of Archæology, Athens 82-4, F by C 84-5, Prof. Greek, Univ. of Kansas, Lawrence.
Wilhelm, Lewis Webb (Balt. C. C. 71, A. B. 80, Ph. D. 84), C 76-7, M 77-80, G 80-1, G S 81-3, F 83-4, F by C 84-5, Baltimore.
Wilkens, Frederick Henry (A. B. 81), M 82-4, Student in Berlin, Germany.
Williams, Frederick Rodgers (A. B. Princ. 82, LL. B. Univ. Md. 85), G 82-3, Att'y at Law, Belair, Md.
Williams, George Huntington (A. B. Amh. 78, Ph. D. Heidelb. 82), F by C 82-3, A 83-5, A Prof. Mineralogy 85-, Baltimore.
Williams, Henry Winslow (A. B. 83, LL. B. Univ. Md. 85), C 81-2, M 82-3, Att'y at Law, Baltimore.

Williams, John Whitridge (Balt. C. C.), M 84-6, Baltimore.
Williams, Langdon, C 83-4, M 84-6, Boston, Mass.
Williams, Lucius Elijah (A. B. Mercer 85), G 85-6, Macon, Ga.
Williams, Nathan Winslow (Balt. C. C., LL.B. Columbia 83), S 79-80, Att'y at Law, Baltimore.
Williams, William Holme (A.B. Wis. 76), G 82-3, F by C 83-4, As't Prof. of Greek, Univ. of Wisconsin, Madison.
Williams, William Klapp, C 83-4, M 84-6, Boston, Mass.
Willis, Edward William (Balt. C.C. 84), P M 84-6, Baltimore.
Willoughby, William Franklin, C and M 85-6, H H S 85-6, Alexandria, Va.
Willoughby, Westel Woodbury, C and M 85-6, H H S 85-6, Alexandria, Va.
Wilson, Edmund Beecher (Ph.B. Yale 78, Ph.D. 81), As't in Zool. Yale 77-9, F 79-81, C Z L 79, 80, 81, 82, As't 81-2, Lect. Wms. Coll. 83-4, Student at Dohrn's Lab. Naples 84-5. A Prof. of Biology, Bryn Mawr Coll., Bryn Mawr, Pa.
Wilson, Henry Merryman, Jr. (M.D. Univ. Md. 82), C 79-80, Physician, Baltimore.
Wilson, Henry Van Peters (Balt. C.C., A.B. 83), M 80-3, C Z L 83, G 83-4, G S 85-6, Baltimore.
Wilson, Woodrow (A. B. Princ. 79, A. M. Princ. 82), G 83-4, F 84-5, A in History, Bryn Mawr Coll., Bryn Mawr, Pa.
Wiltshire, James G. (M. D. Univ. Md. 69), G 76-9, Physician, Baltimore.
Wingert, Henry Firey, C 83-4, M 84-6, Hagerstown, Md.
Winslow, John Randolph, P M 83-4, C 84-5, M 85-6, Baltimore.
Witzenbacher, William John (A. B. 83), C 81-2, M 82-3, Instr. McDonogh School, McDonogh, Md.
Wood, Augustus (A. B. Brown 78), G 82-3, New Bedford, Mass.
Wood, Julian (Ph.B. Univ. N. C. 84), G 84-5, Edenton, N. C.
Wood, Peter Bryson (M. D. Nat'l Med. Coll. 83), P M 78-80, Physician, Baltimore.
Woodhull, John Francis (A. B. Yale 80), G 85-6, Inst. Nat. Sci., State Norm. Sch., New Paltz, N. Y.
Woods, Allan Chase, M and H H S 83-6, Baltimore.
Woods, Hiram, Jr. (A. B. Princ. 79, M. D. Univ. Md. 82), G 79-80, Physician, Baltimore.
Woodward, Richard H., S 84-5, Saluda, Va.
Worthington, Daniel Dulany (A. B. Md. Agric., M. D. Univ. Md. 75), G 76-7, * *November*, 1882.
Worthington, James Cheston (M.D. Univ. Md.), G 80-1, Physician, U. S. Marine Hosp. Service.
Worthington, Thomas Kimber (A.B. Haverf. 83), G 83-6, Baltimore.
Wright, Charles Baker (A. B. Buchtel 80), G 82-4, G S 84-5, F 85, Prof. English Lit. and Rhetoric, Univ. Vt., Middlebury.
Wright, James Paul (B. D. Drew Theol. 71), G 77-9, Minister M. E. Church, Baltimore.
Wylie, Douglas Miller (Balt. C. C.), S 83-4, Baltimore.
Wylie, Hamilton Boyd (M. D. Phys. and Surg. Balt. 77 and Bellevue, N. Y. 78), G 78-9, 80-1, Physician, Baltimore.

Yager, Arthur (A.B. Georgetown, Ky. 79, Ph. D. 84), G 82-3, G S 83-4, Prof. History, Georgetown Coll., Ky.
Yonce, Glosbrenner Victor (A. B. Roanoke 77, A. M., Roanoke 82), G 82-5, Teacher, Luthervilie, Md.
Young, Abram Van Eppa (Ph. B. Mich. 75), As't, Univ. Mich. 75-7, G 77-8, 80-1, F 78-80, As't in Chem. Harvard 84-5, Prof. Chemistry, Northwestern Univ., Evanston, Ill.
Young, Frederick George, C 84-5, M 85-6, Beaver Dam, Wis.

Zweizig, John Henry (A. B. Muhlenberg 82), G 82-5, Reading, Pa.

SUMMARY OF THE FOREGOING LIST OF NAMES.

Total number enrolled	923
Deceased	19
Living	904
Fellows by Courtesy	52
Fellows	138
Graduate Students	515
Matriculates and Candidates for Matriculation	225
Preliminary Medical Students	29
Special Students	161

Degrees.

Graduates of the Johns Hopkins University:	
Bachelors of Arts	90
Doctors of Philosophy	69
Of the Graduate Students there have been admitted to degrees elsewhere,	
Bachelors of Arts	297
Bachelors of Science	63
Bachelors of Philosophy	27
Bachelors of Laws	31
Bachelors of Literature	9
Bachelors of Divinity	7
Bachelors of Engineering	2
Masters of Arts	86
Masters of Science	5
Masters of Literature	1
Doctors of Philosophy	36
Doctors of Medicine	95
Doctors of Science	2
Civil Engineers	16
Mining Engineers	5

Occupations.

Physicians		80
Attorneys		34
Ministers		38
Journalists		5
Teachers:		
in Colleges and Universities	136	
in High Schools and Academies	15	
in other schools	25	
		176
Engaged in scientific pursuits, but not teaching		20
Students elsewhere		55
Now enrolled as students of this institution		314

Geographical Distribution of Students.

The students enrolled above have come from the following States and countries:

Maryland (Baltimore 330)	419
New York	69
Massachusetts	46
Pennsylvania	38
Ohio	31
Virginia	26
North Carolina	24
New Jersey	19
Kentucky	18
District of Columbia	15
Iowa	15
Illinois	14
Wisconsin	14
South Carolina	14
Connecticut	11
Indiana	11
Nebraska	10
California	10
Michigan	9
Georgia	8
Alabama	8
Louisiana	7
Maine	7
Vermont	6
Minnesota	6
Tennessee	5
Missouri	4
New Hampshire	4
Kansas	3
Colorado	3
Florida	2
Rhode Island	2
U. S. Navy (State not given)	2
U. S. Army (State not given)	1
West Virginia	1
Delaware	1
Utah	1
Dakota	1
Canada	14
Germany	5
Japan	5
Russia	3
France	2
Italy	2
England	1
China	1
Cuba	1
Switzerland	1
India	1
Nova Scotia	1
New Brunswick	1

Enrolment, 1876-1886.

Years.	Teachers.	Total Enrolled Students.	Graduate Students, including Fellows.	Matriculates.	Special Students.	Degrees Conferred. A. B.	Degrees Conferred. Ph. D.
1876–77..	29[1]	89	54	12	23	—	—
1877–78..	34	104	58	24	22	—	4
1878–79..	25	123	63	25	35	3	6
1879–80..	33	159	79	32	48	16	5
1880–81..	39	176	102	37	37	12	9
1881–82..	43	175	99	45	31	15	9
1882–83..	41	204	125	49	30	10	6
1883–84..	49	249	159	53	37	23	15
1884–85..	52	290	174	69	47	9	13
1885–86..	49	314	184	96	34	—	—

[1] In the first two years the number of non-resident lecturers was much larger than it has been since.

HISTORICAL STATEMENT.

The Johns Hopkins University was founded by the munificence of a citizen of Baltimore, Johns Hopkins, who bequeathed the most of his large estate for the establishment of a University and a Hospital. The foundation of the University is a capital, in land and stocks, estimated in value at more than $3,000,000; the capital of the Hospital is not less in amount.

1867, August 24.	Incorporation of the Johns Hopkins University.
1870, June 13.	Organization of the Board of Trustees.
1873, December 24.	Death of the Founder [born May 19, 1794].
1874, February 6.	First Business Meeting of Trustees.
1874, December 30.	Election of a President of the University.
1876, February 22.	Inauguration of the President.
1876, October 3.	Instruction of Students began.
1886, April 26.	Celebration of the Tenth Anniversary.

CALENDAR, 1886-87.

The first Examinations for Admission and Matriculation begin Wednesday, June 9, 1886, and continue through the week.

The ceremony of conferring Degrees is appointed for Monday, June 14, 1886, at 6 p. m.

The present academic year closes Tuesday, June 15, 1886.

The eleventh academic year begins on Friday, October 1, 1886, and continues till June 15, 1887.

The autumn Examinations for Admission will begin Friday, October 1, at 9 a. m.

There will be a Christmas Recess, beginning on Friday, December 24, and ending on Monday, January 3; — also a Spring Recess, beginning on Friday, April 8.

SEAL

OF THE

JOHNS HOPKINS UNIVERSITY.

By the formal action of the Board of Trustees, Dec. 7, 1885, an official seal (of which the above diagram is a fac-simile) was adopted, and at a subsequent meeting, April 5, 1886, the following regulations were prescribed by the same authority, with respect to the guardianship of the seal and its use.

Resolved, That the fac-simile of the seal may be printed upon the official reports and registers and other papers proceeding from the Trustees, upon the journals which receive financial support from the University, upon literary and scientific publications proceeding from the University which have received the approbation of the Academic Council, and upon a book plate to be inserted in books belonging to the University library; and that the use of the fac-simile without the authority of the Trustees be forbidden.

In the preparation of the design the authorities were particularly indebted to Stephen Tucker, Esq., of London, Somerset Herald, who revised and arranged the suggestions transmitted to him from Baltimore by Clayton C. Hall, Esq., to whom the University also owes its grateful acknowledgments, for many kind services.

In the design for the seal symbols of learning have been placed in combination with the well-known Arms of Maryland. The arms of the State are those of Lord Baltimore's family which became a part of the Great Seal of Maryland at an early period in the history of the colony.

The emblems adopted to symbolize the University are open books and a terrestrial globe—indicative of literary and scientific studies. These have been placed upon an azure background and occupy the upper portion of the shield, above the name of the State. There is thus presented (in the words of the Somerset Herald,) "an heraldic picture of a University situated in the State founded by Lord Baltimore."

The motto of the University VERITAS VOS LIBERABIT (which has been in use since its organization) is taken from the Gospel of St. John viii. 32. The shield is hung from a bough of oak. The legend upon the border gives the corporate name and place of the foundation, and the date when instructions were begun, viz.: THE JOHNS HOPKINS UNIVERSITY, BALTIMORE, 1876.

GREAT SEAL OF MARYLAND.

The following account of the Great Seal of Maryland has been prepared by the librarian of the University, Dr. Wm. Hand Browne, editor of the Maryland Archives.

The design of the present Great Seal of Maryland was devised by Cecilius, the first Proprietary, in 1649, to replace an earlier seal which had disappeared in what is called "Ingle's rebellion" in 1644. The differences from the first seal were probably introduced as a safeguard against a fraudulent use of the latter, in case it happened to be in bad hands. The commission which accompanied the new seal, contains a minute description of the devices on both sides.

On one side this seal bore the effigy of Baltimore himself in full armor, on horseback, surrounded by the legend—"CAECILIUS ABSOLUTUS DOMINUS TERRÆ MARIÆ ET AVALONIÆ BARO DE BALTIMORE." This part of the seal was *personal*, and liable, of course, to change with each Proprietary.

On the other side it bore the Calvert arms, heraldically described as "paly of six, or and sable, a bend dexter counterchanged," quartered with the Crossland arms, which Baltimore derived from his grandmother, Alicia Crossland, and which are blazoned, "quarterly, argent and gules, a cross flory counterchanged."

On the shield was placed a Palatine's cap, or coronet, signifying the Palatinate jurisdiction of the Proprietary, and above this a helmet bearing the Calvert crest, a ducal crown with two half bannerets, one gold, the other black.

The Calvert supporters were two leopards; but for the Maryland seal Baltimore adopted a farmer and fisherman as emblems of the chief industries of the Province. On a scroll beneath was the motto of the family, "FATTI MASCHII PAROLE FEMINE;" and around the whole ran a legend taken from the fifth Psalm: "SCUTO BONÆ VOLUNTATIS TUÆ CORONASTI NOS."

All this part of the seal was *dynastic*, representing the Proprietary government; and when the State took the government into her own hands, she retained the beautiful and significant historical symbol as the emblem of her sovereignty.

The Johns Hopkins University Circulars are printed by Messrs. JOHN MURPHY & CO., No. 182 West Baltimore Street, Baltimore, from whom single copies may be obtained. They may also be procured from Messrs. CUSHINGS & BAILEY, No. 262 West Baltimore Street, Baltimore. Subscription, $1.00 a year.

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STANDING ANNOUNCEMENTS.

JOHNS HOPKINS UNIVERSITY.

Opened for Instruction in 1876.

The Johns Hopkins University was founded by the munificence of a citizen of Baltimore, Johns Hopkins, who bequeathed the most of his large estate for the establishment of a University and a Hospital. It was intended that these institutions should coöperate in the promotion of medical education. The Hospital buildings are approaching completion.

The foundation of the University is a capital, in land and stocks, estimated in value at more than $3,000,000; the capital of the Hospital is not less in amount.

The University was incorporated under the laws of the State of Maryland, August 24, 1867. Power to confer degrees was granted by the Legislature in 1876.

Suitable buildings have been provided in Baltimore at the corner of Howard and Little Ross Sts., and are furnished with the necessary apparatus and books.

Academic Staff.

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PLAN OF THE CIRCULARS.

The Johns Hopkins University Circulars are published at convenient intervals during the academic year for the purpose of communicating intelligence to the various members of the University in respect to work which is here in progress, as well as for the purpose of promulgating official announcements from the governing and teaching bodies. During the current academic year, eight circulars will be issued in successive months, to be followed at the close of the year by an index.

Although these circulars are designed for the members of the University, they have frequently been called for by institutions and libraries at a distance, and also by individuals who are interested in the literary and scientific activity of this University. Subscriptions and exchanges are therefore received.

TERMS OF SUBSCRIPTION.

For the current year, 1885–6, $1.
For the year 1884–5, (134 pp. in cloth covers), $1.50.
For the year 1883–4, (140 pp. in cloth covers), $1.50.
For the year 1882–3, (156 pp. in cloth covers), $3.
For the years 1879–82, (250 pp. in cloth covers), $5.
Subscribers to the Circulars will also receive the Annual Register and Report of the University.
All subscriptions should be addressed to the "Publication Agency of the Johns Hopkins University."
Communications for the Circulars should be sent in prior to the first day of the month in which they are expected to appear.

PUBLIC LECTURES.

Notice in Respect to the Admission of the Public.

In answer to inquiries, and in correction of some current misapprehensions, the following statements are made in respect to the public lectures given in the Johns Hopkins University.

These courses are academic lectures, designed primarily for the members of the University, and supplementary to the regular class-room work of the students.

As the members of the University rarely require the entire room, the Trustees have taken great pleasure in inviting other persons, not connected with the University, to attend.

As these lectures are not intended for popular entertainment, but for the instruction of students, those persons first receive tickets, in most cases, who are known to be especially interested in a particular course,—ladies as well as gentlemen.

There is no general course ticket issued. Applications should state specifically the course for which tickets are desired. Programmes and other current information pertinent to university work may be found in the *University Circulars*, sent to subscribers, on the payment of one dollar per annum, by the Publication Agency of the University.

The usage of giving personal notification has been discontinued, and those therefore who are interested in such announcements should hereafter consult the *Circulars*.

It will save much delay if applications for tickets and inquiries on these and other routine matters are addressed not to individuals but to the JOHNS HOPKINS UNIVERSITY, *by postal card*, and answers will be promptly returned by mail. Personal applications consume time needlessly.

☞ The lectures begin at 5 o'clock *punctually*. The doors of the hall are opened at fifteen minutes before 5, and the lectures do not exceed an hour in the delivery.

PUBLICATIONS ISSUED UNDER THE AUSPICES OF THE UNIVERSITY.

I. American Journal of Mathematics.

The publication of this journal commenced in 1878, under the editorial direction of Professor Sylvester, and is now conducted by Professor Simon Newcomb as Editor, and Dr. T. Craig as Associate Editor. Seven volumes of about 400 pages each have been issued, and the eighth is in progress. It appears quarterly, in the quarto form. Subscription $5 per year. Single numbers $1.50.

II. American Chemical Journal.

This journal was commenced in 1879, with Professor Remsen as editor. Seven volumes of about 450 pages each have been issued, and the eighth is in progress. It appears bi-monthly. Subscription $3 per year. Single numbers 50 cts.

III. American Journal of Philology.

The publication of this journal commenced in 1880, under the editorial direction of Professor Gildersleeve. Six volumes of about 570 pages each have been issued, and the seventh is in progress. It appears four times yearly. Subscription $3 per volume. Single numbers $1.00.

IV. Studies from the Biological Laboratory.

[*Including the Chesapeake Zoological Laboratory.*]

The publication of these papers commenced in 1879, under the direction of Professor Martin, with the assistance of Dr. W. K. Brooks. Two volumes of about 500 pages, octavo, and 40 plates each, have been issued, and the third is in progress. Subscription $5 per volume.

V. Studies in Historical and Political Science.

The publication of these papers was begun in 1882, under the editorial direction of Dr. H. B. Adams. A first series of 470 pages, a second of 630, and a third of 595 pages are now completed and a fourth series is in progress. Subscription $3 per volume.

The UNIVERSITY CIRCULARS. $1 per year.
The ANNUAL REPORT presented by the President to the Board of Trustees reviewing the operations of the University during the academic year.
The ANNUAL REGISTER giving the list of officers and students and stating the regulations of the University. Published at the close of the academic year.
The University Circulars, Annual Report, and Annual Register will be sent by mail for one dollar per annum.

ROWLAND'S PHOTOGRAPH OF THE NORMAL SOLAR SPECTRUM. Set of seven plates, unmounted, $10; mounted, $12. Single plates, unmounted, $2; mounted, $2.25. 1886.

REPRODUCTION IN PHOTOTYPE OF A SYRIAC MS. WITH THE ANTILEGOMENA EPISTLES. I. H. Hall, Editor. Only 250 numbered copies have been issued. $3. 1886.

STUDIES IN LOGIC. By members of the Johns Hopkins University. C. S. Peirce, Editor. (Boston: Little, Brown & Co.) 1883. 123 pp., 12o. $2.

THE DEVELOPMENT AND PROPAGATION OF THE OYSTER IN MARYLAND. By W. K. Brooks. 1884. 193 pp., 4o. 13 plates and 3 maps. $5.

ON THE MECHANICAL EQUIVALENT OF HEAT. By H. A. Rowland. 1880. 127 pp., 8o. $1.50.

NEW TESTAMENT AUTOGRAPHS. By J. Rendel Harris. 1882. 54 pp., 8o. 4 plates. 50 cents.

SIR WILLIAM THOMSON'S LECTURES ON MOLECULAR DYNAMICS. 1884. 370 pp., 4o. $5.00.

All communications in respect to publications should be addressed to the "Publication Agency of the Johns Hopkins University," Baltimore, Maryland.

MORPHOLOGICAL NOTES.

The Stomatopoda of the "Challenger" Collection.

By W. K. BROOKS.

The "Challenger" collection of Stomatopoda was placed in my hands in March, 1883, with the understanding that my report upon it was to be prepared within two years; but sickness and the pressure of other work compelled me to ask for a longer time, and the report, with sixteen quarto plates, containing about one hundred and twenty original drawings, has just appeared in the "Zoölogy of the Voyage of H. M. S. Challenger," under the title, "Report on the Stomatopoda collected by H. M. S. Challenger during the years 1873–76." 130 pp. 4to.

The collection of adults is a small one, consisting of only fifteen species, but eight of them are new, and two of the others have been very inadequately described from single specimens. The importance of the collection must not, however, be estimated by its size, for it throws light upon many interesting problems, and furnishes the material for a more exhaustive discussion of the phylogenetic relationship and natural classification of the various genera and species than has been possible hitherto.

The collection of pelagic Stomatopod larvae is very rich, and it has yielded the material for tracing the history of several of the larval types, and also for establishing, in every genus except two, the connection between the adults and their proper larvae.

The beautiful, transparent, glass-like pelagic larvae of the Stomatopoda are familiar to all naturalists who have had an opportunity to study pelagic life, and none of the animals which are captured at the surface in the tow-net surpass them in interest to the student, or in beauty and grace. Their perfect transparency, which allows their complicated structure to be studied in the living animal, their great size and rapacity, the graceful beauty of their constant and rapid movements, and the character of the problems which they present for solution, combine to fascinate the naturalist; but they are, unfortunately, as difficult to study as they are interesting, and notwithstanding their great abundance and variety, only two or three of them have been traced to their adult forms.

As no one has succeeded in rearing them from the egg, and as they do not thrive in confinement, the only way to trace the life history of the Stomatopoda is by the comparison of the series of larvae which are collected in mid-ocean, and this is attended with peculiar difficulties, for the larval forms which have been described are more numerous than the known species of adults, and many of them unquestionably belong to species the adult stages of which have never been discovered.

The larval life is long, for the larvae grow very slowly, and as they are as independent and as much exposed to changes in their environment and to the struggle for existence as the adults, they have undergone secondary modifications which have no reference to the life of the adult, and are therefore unrepresented in the adult organism. The larvae actually differ from each other more than the adults do, thus reversing the general rule that larvae are less specialized and therefore exhibit clearer evidences of genetic relationship than mature animals. The problem which they present is similar to, but more difficult than that presented by the Hydro-Medusae, for young medusae can be reared from hydroids in aquaria, and it is not difficult to rear young hydroids from the eggs of medusae, but the life history of the Stomatopoda must be traced from the internal and indirect evidence furnished by comparison. The larvae may be arranged in genera and species, but unfortunately their generic and specific characteristics are quite different from those upon which the adult genera and species have been based. Like the adults, they are very widely distributed, and a gap in the series from the North Atlantic may be filled by a specimen from Australia or the Sandwich Islands; while the collection from a single locality often contains representatives of widely separated species. As they undergo great changes during their growth and metamorphosis, it is not easy to select from the rich gatherings brought home by collectors the successive stages in the history of a single species, and the attempt to unravel the tangled thread of the larval history of the Stomatopoda is attended with very exceptional difficulties. The first step in this direction is to trace the history of each larval type or genus, by the selection and comparison of those larvae which are sufficiently alike to indicate that they may possibly belong in the same series. After a series of larvae has thus been selected on account of general resemblances, careful measurements of each one, when reduced to thousandths of the total length, or to some other standard, and compared with each other, usually give pretty decisive evidence as to their relationship.

The length of a series of Coronis larvae from the Challenger collection were found to be as follows, and if the length of No. 1 be multipled by $\frac{4}{5}$ of itself, and this by $\frac{5}{4}$ and so on, we obtain the series given in the second line,

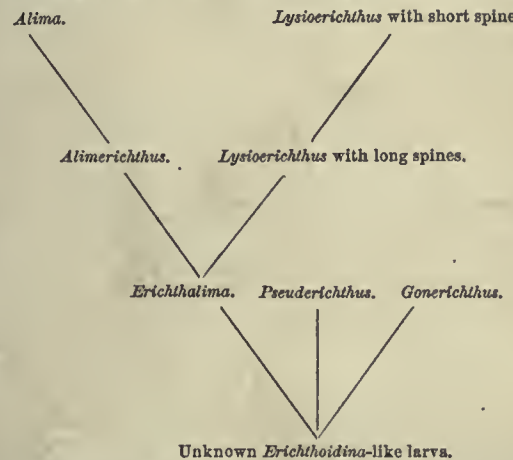
No. 1.	No. 2.	No. 3.		No. 4.
4.16 mm.	5.29 mm.	6.49 mm.		10.21 mm.
4.16	5.20	6.50	8.13	10.16

thus showing that these larvae belong to the same species, or to species which are very closely related, and that stages I, 2, and 3 are consecutive, while there is a missing stage between 3 and 4.

After the metamorphosis of each larval type has thus been traced, by general comparisons, verified by measurements; the next step is to refer each larval type to its proper adult genus. If comparative anatomy enables us to trace, from the study of adults, their natural or genealogical classification, it must be possible to do the same thing with larvae, and if the classifications which are thus established are truly natural, that is genealogical, there must be a discernible relation between the one derived from the larvae and the one derived from the adults, for each larva is only an immature adult, and the genetic history of each adult must be the same as that of a specific larva, namely its own larva.

In most cases no such comparative classification is necessary, for we are usually able to trace the young to its adult form, and to use the whole life-history as a basis for classification; in most cases, too, even if it were necessary, it would be extremely difficult, on account of the embryonic or generalized character of young animals, and the absence of conspicuous specific differences, but it fortunately happens that in the Stomatopoda, where we are compelled to resort to this or some other indirect method of discovering what larva pertains to what adult, it is much more practicable than usual, owing to the high specialization and great diversity of the larvae, which may therefore be treated exactly as if they were adults.

From the comparative study of the larvae, I have obtained the classification which is given in the following diagram.



The provisional genus Gonerichthus including those Erichthi in which the carapace is deep, but not folded inwards ventrally, the hind body convex, the primary spines of the telson long, few or no secondary spines between the sub-median and intermediate primary spines, the outer spine of the basal prolongation of the uropod much longer than the inner, and no marginal spines on the edge of the long slender dactylus; the provisional generic name Pseuderichthus including these Erichthi in which the carapace is deep and slightly infolded, the hind body convex, the dactylus of the raptorial claw sometimes armed, the sub-median spines of the telson long with movable spines at their tips, and one or two secondary spinules between the sub-median and intermediate; the provisional genus Erichthalima has the carapace deep, its lateral edges infolded and serrated, the hind body flat, the telson wider than long, numerous secondary spines on the telson, and the dactylus armed with several teeth; the provisional genus Lysio-

erichthus includes Erichthi which have the carapace very deep, much infolded, and in the younger larvae serrated, the hind body flat and wide, the telson wider than long, from one to four secondary spines between the sub-median and intermediate, and traces of more than six spines on the dactylus; and the provisional genus Alima has a shallow flat carapace, with serrated edges, the hind body flat and wide, the telson longer than wide (except in Alimerichthus), there are numerous secondary spinules between the sub-median and intermediate, and the dactyli have traces of marginal spines which are never more than six in number.

My attempt to trace the phylogenetic classification of the adults brought me face to face with a serious difficulty, as I soon found that the characteristics which have been selected for diagnosis are by no means the ones which are most significant and of most scientific importance. In most of the published descriptions little attention is given to points which are not regarded as diagnostic, and while most of the genera are natural ones the points which are of the greatest value in tracing the relation between the larvae and the adults are entirely ignored in most of the published descriptions. My own studies of the Challenger specimens and of the systematic literature have led me to retain most of the accepted genera, but to give them new diagnoses, and my view of the natural classification of the adults is given in the accompanying analytical key, and phylogenetic system.

Analytical Key, giving the more prominent Diagnostic Characteristics of each Genus.

I. Sixth abdominal somite fused with telson; rostrum with acute median and antero-lateral spines.

a. Dactylus of raptorial claw dilated at the base and unarmed; hind body narrow and thick; marginal spines of telson crowded towards posterior edge.

Genus *Protosquilla* n. g.

II. Sixth abdominal somite distinct; rostrum without antero-lateral spines.

a. Hind body narrow and thick.

1. Dactylus of raptorial claw dilated at base, and unarmed; primary marginal spines of telson very large, with one or two secondary spines on each side between the submedian and the intermediate.

Genus *Gonodactylus.*

2. Dactylus of raptorial claw not dilated at base, usually armed with marginal spines; submedian spines of telson tipped with movable spinules; from one to three secondary spines between the submedian and the intermediate.

Genus *Pseudosquilla.*

b. Hind body depressed and wide.

1. Dactylus of raptorial claw dilated at the base and armed with marginal spines.

Genus *Coronida* n. g.

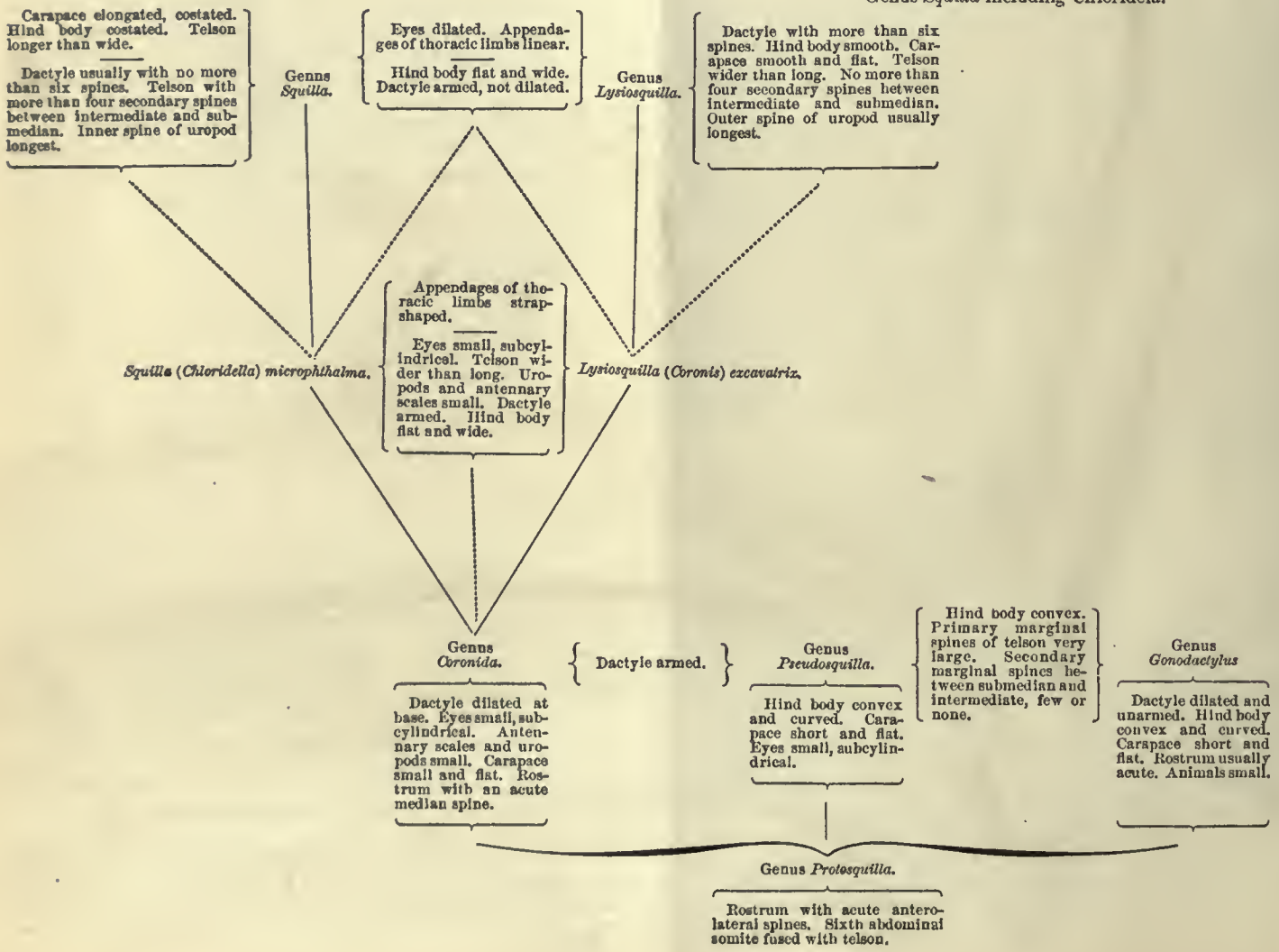
2. Dactylus of raptorial claw not dilated at the base, but usually armed with marginal spines.

(1) Primary marginal spines of telson small, with no more than four secondary spines between the submedian and the intermediate; outer spine of basal prolongation of uropod usually longer than the inner; dactylus of raptorial claw with not less than six marginal spines.

Genus *Lysiosquilla* including Coronis.

(2) Primary marginal spines of telson large, with more than four secondary spines between the intermediate and the submedian; inner spine of basal prolongation of uropod longer than outer; dactylus of raptorial claw usually with no more than six marginal spines.

Genus *Squilla* including Chloridela.


Carapace elongated, costated. Hind body costated. Telson longer than wide.
Dactyle usually with no more than six spines. Telson with more than four secondary spines between intermediate and submedian. Inner spine of uropod longest.
Genus Squilla.
Eyes dilated. Appendages of thoracic limbs linear.
Hind body flat and wide. Dactyle armed, not dilated.
Genus Lysiosquilla.
Dactyle with more than six spines. Hind body smooth. Carapace smooth and flat. Telson wider than long. No more than four secondary spines between intermediate and submedian. Outer spine of uropod usually longest.
Squilla (Chloridella) microphthalma.
Appendages of thoracic limbs strap-shaped.
Eyes small, subcylindrical. Telson wider than long. Uropods and antennary scales small. Dactyle armed. Hind body flat and wide.
Lysiosquilla (Coronis) excavatrix.
Genus Coronida.
Dactyle dilated at base. Eyes small, subcylindrical. Antennary scales and uropods small. Carapace small and flat. Rostrum with an acute median spine.
Dactyle armed.
Genus Pseudosquilla.
Hind body convex and curved. Carapace short and flat. Eyes small, subcylindrical.
Hind body convex. Primary marginal spines of telson very large. Secondary marginal spines between submedian and intermediate, few or none.
Genus Gonodactylus
Dactyle dilated and unarmed. Hind body convex and curved. Carapace short and flat. Rostrum usually acute. Animals small.
Genus Protosquilla.
Rostrum with acute antero-lateral spines. Sixth abdominal somite fused with telson.

A comparison of this phylogeny derived from the study of the adults with the one given above, derived from the study of the larvae, will show their close resemblance. Faxon has reared a Squilla empusa from an Alima. I have reared Lysiosquilla (Coronis) excavatrix n. *sp.* from a long-spined Lysioerichthus; the Challenger collections enable me to trace Lysiosquilla maculata to a short-spined Lysioerichthus; Claus has obtained a very complete series of larvae connecting Pseuderichthus with Pseudosquilla, and the Challenger collections give a very complete series connecting Gonerichthus with Gonodactylus, and the indirect evidence is very strong to show that all the Alimae are young Squillae, all the Lysioerichthi young Lysiosquillae, all the Pseuderichthi young Pseudosquillae, and all the Gonerichthi young Gonodactyli, and Erichthalima very probably a young Coronida.

Observations on the Embryology of Insects and Arachnids. By A. T. Bruce.

[Abstract of a thesis presented for the degree of Doctor of Philosophy, May, 1886].

The work of which a short abstract is here given comprises observations extending over a period of nearly two years.

A more detailed and illustrated account now in course of preparation will, it is hoped, show that if these observations have not brought to light anything absolutely new they have at least thrown additional light on several important questions in insect embryology.

With insect eggs the opacity of which renders them unsuitable for superficial observation the sectional method leads to the best results. This method was followed in these investigations.

The important points to be determined in insect embryology are the segmentation of the egg and the formation of the blastoderm, the origin of the embryo and embryonic membranes, the formation of the germinal layers, metameric segmentation and all connected with it including number of appendages, nerve ganglia and etc.

The embryology of Arachnids or at least of spiders shows many points of resemblance to the embryology of insects. The first trace of the spider embryo, the so called primitive cumulus, is not unlike the early embryo of the orthoptera. In the head region of the advanced spider embryo are folds which very closely resemble the amniotic folds of the insect embryo.

The insects studied included representatives from the Lepidoptera, Coleoptera and Orthoptera, while a few incomplete observations were made in the embryology of the Neuroptera and on the maturation of the ovum in Musca.

The eggs of the spiders studied probably belonged to several species.

The embryology of Thyridopteryx ephemeraeformis or the common bag worm was carefully studied. Owing to abundance of material its development was followed from the early stages of segmentation to the advanced embryonic stage.

The segmentation of the egg of Thyridopteryx corresponds to that of the lepidopterous insects described by Bobretzky. It can hardly be called a centrolecithal segmentation inasmuch as in the earliest stages cells are found not at the surface surrounding a central yolk mass, but lie in the yolk whence they migrate to the surface to form the blastoderm.

In Thyridopteryx, it appears that some of the primitive embryonic cells never reach the surface but remain as yolk cells, round each of which, in the later stages of embryonic development, an aggregate of yolk spherules occurs and thus are formed the yolk balls or segments.

In the grasshopper, however, there is a stage in which all the undifferentiated cells are apparently at the surface, while the yolk is arranged in pyramids corresponding to the yolk pyramids of Artocus.

In Meloë, the species of beetle studied, probably a corresponding stage occurs in which all the cells are at the surface, though there are no yolk pyramids; consequently, in the grasshopper and in Meloë the yolk cells probably arise by delamination from the cells investing the yolk.

The embryo of Thyridopteryx and of other insects studied arises as a thickening on the surface of the egg not unlike the primitive cumulus of spiders.

The amniotic folds arise as folds of blastoderm on all sides of the embryo and finally meet and unite over the median line of the ventral plate, consequently the embryo (described as the ventral plate at this stage) comes to lie in the yolk covered by the inner amniotic fold or true amnion, while the outer fold or serosa remains continuous with the blastoderm. The embryonic membranes of Mantis and Meloë arise in a quite similar manner. Brandt has described a different mode of origin for the embryonic membranes of the Neuroptera and Hemiptera.

After the formation of the membranes in Thyridopteryx, but synchronously with the same in Mantis and Meloë, an ingrowth occurs in the middle line of the embryo which is partly a delamination and partly an invagination. By this ingrowth is formed the inner germ layer which in Thyridopteryx certainly corresponds to both mesoderm and endoderm. The yolk cells do not appear to take any part in the formation of the endoderm in Thyridopteryx. Tichomiroff, from his studies in the Lepidoptera, comes to a similar conclusion in regard to the yolk cells.

The yolk cells of the grasshopper also appear to take no part in the formation of the endoderm.

The amnion in Thyridopteryx grows dorsally more rapidly than the body walls and its opposite folds unite dorsally before the body walls can grow together. Consequently the amnion in this insect forms part of the dorsal surface of the body, while for a time the entire embryo is enclosed as in a sack by the outer fold of the true amnion which does not take part in the closure of the dorsal surface.

No dorsal organ corresponding to that described by Brandt for the Neuroptera was observed in Thyridopteryx or in the other insects studied. The amnion of the grasshopper does not apparently form any considerable portion of the dorsal wall of the body.

The nervous system arises in all insects studied as two ectodermic strings lying on each side of the blastopore, as the median line where the inner layer arises may be called. It subsequently divides into a number of ganglia corresponding to the somites of the body. The supracesophageal ganglion, as good longitudinal sections of the Thyridopteryx embryo show, consists of two portions,—a posterior portion which innervates the paired labum, and an anterior portion which supplies the antennae with nerves. The circumœsophageal commisure is formed by a portion of the posterior division of the supracesophageal ganglion and a portion of the mandibular division of the subœsophageal ganglion. The supracesophageal ganglion of Thyridopteryx has its halves united by a double commisure, one portion crossing above and the other below the œsophagus. When the nervous system has been separated from the superficial ectoderm a median ingrowth of ectoderm occurs in Thyridopteryx between the nerve cords. The cells comprising this ingrowth elongate and lie close to the nerve cords.

At this stage it appears as if this median ingrowth were uniting the cords and forming a commisure as Hatscheck claimed for the Lepidoptera studied by him. This, however, does not prove to be the case. In a subsequent stage the elongated epithelial cells undergo division and give rise to migratory cells corresponding to other migratory mesoderm cells. Cells of this nature invest the nervous system forming its peritoneal coat, but take no part in the formation of its commisure. The three pairs of thoracic limbs are conspicuous from their size in all embryos studied.

In the grasshopper both maxillae have two lobes outside of and at the base of the main axis of the appendage. These recall, though they are probably not homologous with, the exopodites and epipodites of the crustacean appendage. Similar lobes have been described by Patten for the maxillae of Blatta. Tracheal invaginations occur in the maxillary segments of the grasshopper. In conclusion it remains to mention an interesting stage of the spider embryo in which an abdominal appendage is being converted by a process of invagination into a lung book.

Notes on the Embryology of the Gasteropods. (Preliminary notice.) By J. Playfair McMurrich.

In a number of the *Studies from the Biological Laboratory*, which will appear during the coming summer, I intend publishing a detailed and illustrated account of the results of my studies during the past winter upon

the development of some marine Prosobranch Gasteropods. In the meantime, however, it is desirable that a brief abstract of some of the more important results should be presented.

The forms studied principally were *Fulgur carica* and *Fasciolaria tulipa*. The former furnished material for the earlier stages of the development, while of the latter I studied only the more advanced embryos. The modes of segmentation of a few other forms, such as *Purpura floridana*, *Crepidula*, and *Eupleura caudata*, were also observed.

The first portion of my paper will deal with the ovum and the nutrition of the embryo, the non-development and employment as nutrition of the majority of the ova in each capsule of *Fasciolaria* being described and compared with other phenomena of a similar kind. In *Purpura floridana* a certain number of the ova, after segmenting regularly for some time, break down, and are employed as food by the survivors; in *Crepidula* we see the same process, but in a much less marked degree; while in *Neritina* it is carried to a greater extent, only one egg, out of a great number which, in each capsule, undergo segmentation, coming to maturity. In *Fasciolaria* six or eight eggs develop in each capsule, the remaining ova showing not the slightest trace of segmentation, the polar globules even remaining unformed, although the ova contain a nucleus and a certain amount of protoplasm and are not simply yolk masses.

The second portion of the forthcoming paper will deal with the segmentation of *Fulgur*. The eggs are very large, containing much yolk. A single large polar globule is formed which contains some yolk granules. The ovum then segments into two and then four equal spherules and from these are separated four small protoplasmic spherules, the micromeres. These then divide after four more micromeres have been separated from the macromeres as in the normal Gasteropod segmentation. In one point, however, *Fulgur* differs from other forms which have been studied; the number of generations of micromeres which are separated off from the macromeres, is very large—apparently they continue to be separated off as long as any portion of the macromeres remains uncovered by the ectoderm. And even after the blastopore has formed and closed at the nutritive pole of the egg, there can be seen, in the interior of the yolk mass, which represents the fused macromeres, or beneath the ectoderm at the surface of the yolk mass, cells which resemble, in certain characteristic features, the micromeres which were separated from the macromeres. These late appearing micromeres, as they may be termed, I believe, assist in the formation of the mesoderm, this layer not being formed in its entirety from the primitive mesoderm cell.

When the segmentation has progressed somewhat, but while the micromeres are still confined to the formative pole, three of the macromeres show elongated elevations upon their surfaces. The fourth macromere has no elevation, but gives rise to the primitive mesoderm cell. What the significance of the elevations may be, I cannot imagine, but there can be no doubt but that their appearance is normal and coincides with the formation of the first mesoderm cell. This lies below the margin of the ectoderm cell, and corresponds exactly with the primitive mesoderm cell of *Nassa*.

At a later stage an invagination of the ectoderm at the formative pole takes place. A deep depression is formed, which, however, later disappears and leaves no trace. It apparently corresponds with the similar invagination described by Blochmann in *Neritina* and by Sarasin in *Bithynia*, though the description given in this latter case is not very clear.

The development of the endoderm I was not successful in observing. The blastopore is formed at the formative pole of the ovum, and closes, the mouth being formed at the point of closure by an ectodermal invagination which also gives rise to the œsophagus.

The general considerations derived from the study of the segmentation of the Gasteropods will be arranged under three divisions. The first will treat of the influence of the yolk on the formation of polar globules, the second on the phylogenetic significance of segmentation, in which it will be held that the mode of segmentation seen in *Fulgur* and so many other Gasteropods is essentially the same as that which occurs in certain Hirudinea, Gephyreans, Turbellarians, etc., and that what is to be seen in the Lamellibranchs, Annelida, and other aberrant groups can be referred to the same mode; or in other words that the Platyhelminths, Annelida, Mollusca, and Molluscoidea, have been derived from forms which possessed a typical segmentation similar to that now to be seen in the Pulmonates and many other Gasteropods, many forms in each group, however, having departed from the original mode by reason of subsequent loss or addition of food yolk. It will follow, as a consequence of this idea, that the regular equal segmentation, which occurs in many forms belonging to these groups, is not primitive, but has been secondarily induced by the conditions under which the eggs segment. The third division of the theoretical considerations will treat of the mesoderm.

The third and fourth portions of the paper will treat respectively of the velum and primitive excretory organs.

The fifth portion will treat of the development of the nervous system. It will be shown that the Lamellibranchs, Pteropods, and Heteropods agree in the formation of their supra-œsophageal ganglion with the typical Trochophore larva of *Polygordius*. In the marine Prosobranchs however the supra-œsophageal ganglia arise as independent local ectodermal thickenings, which have directly nothing to do with a "Scheitel-platte," and which become united with each other and with the pedal ganglia later. Between this arrangement and that of Pteropods, etc., the Pulmonates offer an intermediate stage. The problematic cells which have been described by so many authors as lying in the head vesicle, and derived from the ectoderm, and which were recognized by Wolfson to be a nervous organ in process of degeneration, no doubt represent the apical thickening from which, in the Trochozoon, the Pteropods, etc., the supra-œsophageal ganglia are formed. In the Pulmonates the ganglia do not form from these problematic cells, which soon degenerate and disappear, but are formed as in the marine Prosobranchs from local proliferations of the ectoderm. There has been an abbreviation of the development in the case of the Pulmonates and Prosobranchs, and it is interesting to note that the latter group presents wide differences from the other Molluscan larvae in other respects also, *e.g.*, the excretory organs. The Prosobranch Veliger seems to be very highly specialized, and affords an excellent instance of larval specialization independent of the specialization of the adult.

The Origin of Metagenesis among the Hydro-Medusae. By W. K. Brooks.

Most of the recent writers upon the origin of the sexual medusae which are set free from communities of sessile hydroids, and upon the relation between them and the hydroids, agree in the opinion that the sessile community is the primitive form, from which the medusae have been derived through division of labor, and the gradual specialization of the reproductive members of a polymorphic hydroid-cormus.

In a monograph which has just been published in the Memoirs of the Boston Society of Natural History ("The Life-History of the Hydro-Medusae: A discussion of the origin of the Medusae, and of the significance of Metagenesis,") I show that the life history of the Narcomedusae and Trachomedusae is irreconcilable with this view. The accepted view regarding these groups of Medusae is that they have been evolved from ancestors with a sessile hydra-stage and an alternation of generations, and that they have gradually lost the hydra stage, so that they now develop directly from the egg. I show that there is no reason for this opinion, but that we have, in Liriope among the Trachomedusae and in Aeginata and Cunina octonaria among the Narcomedusae, a true planula stage and a true hydra stage, although the hydra is simply a larva which develops into a medusa by direct growth and metamorphosis without alternation of generation. The life history of these forms proves conclusively that the medusa stage is older than the sessile hydroid-cormus, which has arisen through the power to multiply asexually which is possessed by the hydroid larva of the medusa.

We have among the existing hydroids the series of stages in the origin of metagenesis, which are represented in the following diagrams, in which the sign = denotes direct metamorphosis without multiplication; the sign × denotes asexual multiplication, and the sign < denotes sexual multiplication.

In Æginopsis, as Metschnikoff shows, the egg gives rise to a ciliated swimming planula, which acquires a mouth and tentacles and thus becomes directly and gradually converted into a floating hydra or *actinula* which is at first ciliated like the planula. The tentacular zone of the floating hydra now grows out into a flange or umbrella which carries the tentacles with it; sense organs and a veil are soon acquired and the hydra becomes a medusa.

The whole process is perfectly simple and direct; there is nothing like an alternation of generations and the single egg becomes a single medusa

with an actinula stage, a floating hydra-like larval stage and a swimming medusa stage. The life-history is as simple and uninterrupted as that of any other animal which undergoes a metamorphosis, and it may be represented by the following simple diagram.

I. ÆGINOPSIS *Egg = Planula = Actinula = Medusa = < Eggs.*

As the floating hydra stage of Tubularia is well known under the familiar name *Actinula* and as it seems desirable to use a special term for the free hydra stage of medusæ as distinguished from a sessile hydroid, I shall employ this word for this purpose, designating by it a free or floating hydra which may or may not be ciliated.

I have shown that we have in Liriope and its allies a life-history which is very similar to that of Æginopsis, with numerous secondary modifications, most of which are due to the fact that the gelatinous substance of the umbrella begins to be secreted between the endoderm and the ectoderm at a very early stage in the life of the embryo. The acceleration of the formation of the umbrella is exactly paralleled by innumerable similar phenomena in the lives of nearly all of the higher metazoa, and it therefore presents no difficulties; and if we imagine the gelatinous substance absent, the mouthless, untentaculated, ciliated Liriope larva is obviously a planula with an outer layer of ectoderm and a central capsule of endoderm. It has a spacious digestive cavity; the two layers are separated by a gelatinous substance; and in our species, the cilia are restricted to a small part of the outer surface; but, in spite of these secondary modifications, it is clearly a planula. It soon acquires a mouth and four solid tentacles, and becomes converted into the floating hydra or actinula, with ectoderm, endoderm, stomach, mouth, lasso-cells, and four tentacles, but with neither sub-umbrella, sense organs nor veil. This larva becomes converted into an adult medusa by the growth of the tentacular zone into an umbrella, and by the acquisition of sense organs, precisely like the Æginopsis larva and as each egg gives rise to only one adult the life-history is simple and direct with a planula stage, a hydra stage and a final medusa stage, and it may therefore be represented by the same diagram which was used for Æginopsis.

II. LIRIOPE *Egg = Planula = Actinula = Medusa < Eggs.*

In our common American Narcomedusa, *Cunina octonaria*, the fact that the larva is a true hydra was long ago pointed out by McCrady. The planula stage of this species has never been observed, but the resemblance between the ciliated, bitentaculated hydra and Metschnikoff's account of the Æginopsis larva at the same stage is so close that we have every reason for believing that, in this species also, the hydra stage is preceded by a planula stage without a mouth or tentacles. The hydra soon acquires two more tentacles and is then fundamentally like the four-tentaeled hydra of Liriope. The number of tentaeles soon increases to eight, and the hydra becomes converted into a medusa by the outgrowth of the tentacular zone and the acquisition of sense organs. So far, the life-history of our Cunina is as simple as that of Æginopsis or Liriope, but it is complicated by the occurrence of asexual multiplication in the larva and also by parasitism. The actinula, or floating ciliated hydra, after gaining access to the sub-umbrella of a Turritopsis, gives rise to buds from the aboral end of its body, behind the circlet of tentacles; each of these buds is a hydra like the parent and like it becomes directly converted into a medusa. As these secondary hydras originate as buds, they are at first sessile, but they become detached while in the hydra stage, or at least before they are completely converted into true medusæ: the time of detachment is not constant and although the larvæ are at first sessile, and, therefore, not actinulas, they serve to show that the boundary line between a floating actinula and a sessile hydra is an extremely faint one.

Owing to the occurrence of asexual multiplication, each Cunina egg may give rise to an indefinite number of adult medusæ, but as each larva becomes directly converted into a medusa by a process of growth, there is no alternation and the life-history may be represented by the following diagram:

III. CUNINA OCTONARIA *Egg = Planula = Actinula = Medusa < Eggs.*
Hydra = Medusa < Eggs.
×
Hydra = Medusa < Eggs.

Here we have asexual multiplication without alternation, but in the Cuninas which Uljanin and Metschnikoff studied there is a true alternation which is obviously of secondary origin and undoubtedly due to a very slight modification of such a life-history as the one shown in diagram III. The planula itself is very peculiar and is furnished with an anomalous pseudopodial apparatus for clinging to and fastening upon the gastric process of the Geryonid within which it becomes a parasite; and the actinula, or primary hydra, into which it becomes converted, never completes its development into a perfect, free medusa. It remains as a brood-stock, from which other larvæ are budded, and these are set free and become converted into medusæ so that the life-history is represented by the following diagram, in which for the first time, we find a true alternation:

IV. CUNINA (CUNOCANTHA) PARASITICA
Egg = Planula = Actinula { *Hydra = Medusa < Eggs.* / *Hydra = Medusa < Eggs.* / *Hydra = Medusa < Eggs.*

A comparison of Metschnikoff's account of the development of *Cunina* (*Cunocantha*) *parasitica*, and that which I have given of *Cunina octonaria*, will bring out an interesting and significant difference between them which I have not yet pointed out. In the American Cunina, the hydra stage is well marked in the larvæ which are produced by budding as well as in the one which hatches from the egg. In Metschnikoff's species, however, the characteristics of the adult medusa begin to make their appearance in the secondary buds, almost as soon as the buds themselves appear, and it would be difficult to recognize a hydra stage in the life of this species if we were not acquainted with the simpler life-history of the American Cunina. In Metschnikoff's species, the primary hydra is also greatly modified as an adaptation for its parasitic life, but in other respects its life-history is very similar to that of the ordinary hydroids; and if the acquisition of the medusa characteristics by the secondary buds were a little more accelerated so that their hydra characteristics were entirely, instead of almost, crowded out, we should have a life-history like this:

V. *Egg = Planula = Actinula* × { *Medusa < Eggs.* / *Medusa < Eggs.* / *Medusa < Eggs.*

I know of no hydra which presents this life-history without modification, but there are many Campanularians and Tubularians in which the only modification is the acquisition by the actinula or primary hydra of the power to produce, in addition to the buds which become medusæ, other buds which remain in the hydra condition, and share with their parent, the primary hydra, the power to produce both kinds of buds. Thus in Perigonomus (Stomatoca), the egg gives rise to a planula which becomes the first hydra, and this produces other hydras like itself and builds up a hydroid cormus; and ultimately all these hydras give rise to buds which become directly converted into medusæ, the hydra-like stage being completely suppressed; and we have a life-history like this:

VI. *Egg = Planula = Actinula or Primary Hydra* ×
Hydra × { *Medusa < Eggs.* / *Medusa < Eggs.*
Hydra × { *Medusa < Eggs.* / *Medusa < Eggs.*
Hydra × { *Medusa < Eggs.* / *Medusa < Eggs.*
Hydra × { *Medusa < Eggs.* / *Medusa < Eggs.*
Hydra × { *Medusa < Eggs.* / *Medusa < Eggs.*

In Turritopsis we have essentially the same life history, except that there is a secondary alternation between the primary hydra and the others. The planula does not become a hydra, but a mouthless, untentaculated root which is undoubtedly a degraded actinula or primary hydra. It does not give rise to medusa buds, but remains as a brood stock or embryonic hydra from which fully developed hydras are formed by budding, and all of these produce medusa-buds, so the life-history is as follows:

TURRITOPSIS *Egg = Planula = Root* ×
Hydra × { *Medusa < Eggs.* / *Medusa < Eggs.*
Hydra × { *Medusa < Eggs.* / *Medusa < Eggs.*
Hydra × { *Medusa < Eggs.* / *Medusa < Eggs.*

In the ordinary Campanularians, with free Medusæ, we have a new element of complexity, owing to the appearance of polymorphism. The ordinary hydras no longer give rise to medusa-buds, and these are produced only on the reproductive hydras or blastostyles. In Eutima, which I shall take as an example of this group, we have another complication, which is very significant.

As in Turritopsis, there is a secondary alternation of generations, for as I have shown above the planula no longer becomes converted into a hydra but forms a root from which the primary hydra is budded like those which appear later.

As I have shown, this secondary alternation occurs in many hydroids, such as Hydractinia, Eutima, Turritopsis, Obelia (Merejkowsky) and others, and it was correctly described by Wright in Hydractinia in 1856; but, so far as I am aware, no one has pointed out that it is a true alternation, exactly like the alternation between the hydra and the medusa, and that it is certainly a secondary acquisition, as we may see from the fact that in Tubularia, Eudendrium and other hydroids, the planula becomes directly converted into a hydra. So far as this point is concerned, the life-history of Eutima or Hydractinia, and that of Tubularia or Eudendrium present the following contrast.

TUBULARIA *Egg = Planula = Actinula =* { *Hydra* × *Hydra* × *Hydra*

with no alternation, while the other forms we have

EUTIMA *Egg = Planula = Root* × { *Hydra* *Hydra* *Hydra*

with an alternation.

The complete life-history of Eutima with its double alternation between the root and the hydranths, between the hydranths and the medusæ and its polymorphism, and division of the hydranths into nutritive persons and blastostyles, may be represented as follows:

VII. EUTIMA *Egg = Planula = Root* ×
- *Nutritive Hydra* × { *Blastostyle.* × { *Medusa < Eggs.* *Medusa < Eggs.* *Medusa < Eggs.*
  Nutritive Hydra
- *Nutritive Hydra* × { *Nutritive Hydra*
  Blastostyle × { *Medusa < Eggs.* *Medusa < Eggs.* *Medusa < Eggs.*

In Podocoryne (Dysmorphosa) we have an extremely complex life-history, which, however, is readily derivable from one like that of Entima as just given. There is a secondary alternation between the root and the hydranths as in Eutima, and the polymorphism between the hydranths is more specialized, as we find not only nutritive polyps and blastostyles but defensive polyps as well, and as each of the medusæ in addition to its sexual function, also possesses the power to produce other medusæ by budding, the number of sexual animals which may be derived from a single egg is unlimited.

The following diagram represents the life-history of this species, except that the first generation of medusæ, like the second, gives rise to reproductive elements.

VIII. PODOCORYNE *Egg = Planula = Root* ×

Nutritive Hydra × { *Nutritive Hydra* *Blastostyle* *Defensive Hydra* } × { *Medusa* × { *Medusa < Eggs.* *Medusa < Eggs.* } *Medusa* × { *Medusa < Eggs.* *Medusa < Eggs.* }

×

Nutritive Hydra × { *Nutritive Hydra* *Blastostyle* *Defensive Hydra* } × { *Medusa* × { *Medusa < Eggs.* *Medusa < Eggs.* } *Medusa* × { *Medusa < Eggs.* *Medusa < Eggs.* }

×

Nutritive Hydra × { *Nutritive Hydra* *Blastostyle* *Defensive Hydra* } × { *Medusa* × { *Medusa < Eggs.* *Medusa < Eggs.* } *Medusa* × { *Medusa < Eggs.* *Medusa < Eggs.* }

×

Nutritive Hydra × { *Nutritive Hydra* *Blastostyle* *Defensive Hydra* } × { *Medusa* × { *Medusa < Eggs.* *Medusa < Eggs.* } *Medusa* × { *Medusa < Eggs.* *Medusa < Eggs.* }

×

Nutritive Hydra × { *Nutritive Hydra* *Blastostyle* *Defensive Hydra* } × { *Medusa* × { *Medusa < Eggs.* *Medusa < Eggs.* } *Medusa* × { *Medusa < Eggs.* *Medusa < Eggs.* }

×

Nutritive Hydra × { *Nutritive Hydra* *Blastostyle* *Defensive Hydra* } × { *Medusa* × { *Medusa < Eggs.* *Medusa < Eggs.* } *Medusa* × { *Medusa < Eggs.* *Medusa < Eggs.* }

It is very probable that future research will show that even this complex diagram is too simple for some of the Hydromedusæ, and that there is, in some cases, a secondary alternation between the first generation of free medusæ and those which are produced by budding from this generation. The life-history of these proliferous medusæ has not been studied, as they are seldom found near laboratories and appliances for research, but there is reason to suspect that in some of them only the medusæ which are budded from the bodies of the medusæ of the first generation become sexually mature; and if future research should prove this we should have still another alternation between the asexual proliferous medusæ and these sexual descendants.

In Hydractinia, the eormi of which are so similar to those of Podocoryne that a drawing of one will correctly represent the other, the life-history begins to simplify itself by the degradation of the sexual medusæ into sessile buds, or reproductive organs, which, however, still retain traces of their former independent locomotor existence; traces which have almost totally disappeared in Eudendrium and in many of the Campanularians.

The life-history of Hydractinia may be represented as follows:

IX. HYDRACTINIA *Egg = Planula = Root* ×
- *Nutritive Hydra* × { *Nutritive Hydra* *Blastostyle* *Defensive Hydra* } × { *Medusa Bud < Eggs.* *Medusa Bud < Eggs.* }
- *Nutritive Hydra* × { *Nutritive Hydra* *Blastostyle* *Defensive Hydra* } × { *Medusa Bud < Eggs.* *Medusa Bud < Eggs.* }
- *Nutritive Hydra* × { *Nutritive Hydra* *Blastostyle* *Defensive Hydra* } × { *Medusa Bud < Eggs.* *Medusa Bud < Eggs.* }

Now, what is the significance of this remarkable series of life-histories? Most of the facts have long been known, but the most conflicting interpretations of them have been advanced, and the student who seeks in the various monographs upon the subject an exposition of the relation between the direct development of a single adult from each egg, which is characteristic of most animals and the circuitous history which is so remarkably exhibited by the medusæ, will find a speculative literature which is almost unlimited, but a total lack of agreement as to the true solution of this, the most interesting of all the problems involved in the life of these most interesting animals.

The view which I believe to be the true one, is that the remote ancestor of the hydro-medusæ was a solitary swimming hydra, or actinula, with no medusa stage, but probably with the power to multiply by budding. I believe that this pelagic animal gradually became more and more highly organized and more perfectly adapted for a swimming life, until it finally became converted into a medusa with swimming-bell and sense organs, developing directly from the egg without alternation, but exhibiting during its growth the stages through which it had passed during its evolution. After this stage of development had been reached I believe that the larva derived some advantage from attachment to other bodies, either as a parasite within other medusæ, or as what may perhaps be called a semi-parasite, upon other floating bodies such as the fronds of algæ; and that it multiplied asexually in this sessile condition, giving rise to other larvæ like itself, all of which became medusæ.

I believe that the sessile or attached mode of life of the larvæ proved so advantageous to the species, that it was perpetuated by natural selection, and that the primary larva then gradually lost its tendency to become a medusa, but remained a sessile larva, giving birth by budding to other larvae which became sexual medusæ; and that the medusa-characteristics of these secondary larvæ were accelerated, and that the primary larva gradually acquired, at the same time, the power to produce other larvæ which remained permanently, like itself, in the hydra-stage; that in this way the sessile hydra-communities with medusa buds and free sexual medusæ were evolved; and that finally these communities became polymorphic, and that the sessile habit proved so advantageous that the free medusæ became degraded into medusa-buds, or sexual buds on the bodies of the sessile hydras.

The MARINE LABORATORY of the University will be located, this summer, at Nassau, New Providence. The party and the outfit of the laboratory will be transported from Beaufort, N. C. to Nassau by a schooner which will leave Baltimore about May 10th. At Nassau a building will be rented for use as a laboratory and the work will continue there about two months. The party will consist of W. K. Brooks, Ph. D., Director, and Messrs. E. A. Andrews, A. B., F. H. Herrick, A. B., G. B. Haldeman, A. B., T. W. Mills, M. D., H. Orr, Ph. D., H. V. Wilson, A. B., and, possibly, two or three others.

REPORTS OF RECENT LECTURES AND ADDRESSES.

On Methods of Archæological Research in America.

By Professor F. W. Putman.

[Abstract of a lecture delivered before the University Archæological Society, December 16, 1885].

Mr. Putnam first called attention to the importance of understanding the archæology of America in arriving at a knowledge of the early conditions of man and the beginnings of art, as it is here that man can be traced from a period before the glacial epoch through all his early stages, and from savagery through barbarism to the beginning of civilization.

During this long period in America man moved onward and developed comprehensive social organizations, and made great advances in all primitive arts. Here is material in abundance from which to study the development of his arts up to a certain point. On making such a study much is found which leads to an understanding of the natural development of the arts among other races, and while many phases are found to be common to humanity, resemblances and identities are observed which have a deep ethnological significance and can be classed no longer as mere coincidences. Such a study also leads to conclusions which indicate that the ancient Americans were not the homogeneous people generally supposed.

After allusions to the importance of thorough work in the field and the necessity of following perfect scientific methods in a study of the antiquities of the country, in order that all facts can be properly correlated, he stated that here, as elsewhere, archæology as a science is of late origin; therefore, only work accomplished in recent years, except in a few instances, should be considered in drawing deductions. He said that the day had passed when a simple collector of relics of the past could be called an archæologist. To the general collector of "relics" in this country everything was Indian. To such a one a piece of pottery was an Indian vessel and nothing more. From collections made in that spirit nothing can be learned. The time has come when we must know the exact conditions under which every object placed in our museums of archæology was obtained and its association with other things, in order to draw conclusions of any scientific value.

He then described the methods which should be followed in explorations, in order that everything found, from a chip of stone to an elaborate piece of carving; from a mass of clay to a perfect vase or a terracotta figure; from a splinter of bone to an implement made of that material; from a shell to a carving on a piece of shell; from nuggets of copper and other native metals to beautifully-worked ornaments; together with implements and ornaments of various materials, broken or whole, remains of charred fibres, matting and cloth; and seeds, nuts, corn-cobs and bones of animals, and one and all shall show their associations and tell their story as a whole.

With these should be preserved all human remains, from fragments of bones to perfect skeletons. Skulls are unquestionably the most important, but other parts of the skeleton should be studied as well. All these objects should be studied comparatively; their associations should never be overlooked, and individually and collectively, they should be compared with similar groups of objects from near and remote places. Deductions of importance can be drawn only from material obtained by such methods.

He then gave an account of the explorations of mounds, burial places, and village sites in the Ohio valley which had been conducted, with the assistance of Dr. C. L. Metz, under his personal direction for the Peabody Museum of American Archæology and Ethnology at Cambridge, illustrating his remarks by diagrams and photographs. Trenching and slicing, he said, could be used to express in general terms the method followed in field work. For instance, in exploring a mound a trench is first dug at the base of the mound. A slight vertical wall is made thereby showing the contact of the edge of the mound with the earth upon which it rests. Sometimes this trench has to be dug to the depth of several feet in order to find the bottom of the mound, as in cases where the mound is erected in an excavated area. This wall is the first section of the exploration, and its outline should be drawn or photographed and its measurements noted. For the latter purpose it is best to stretch two strings over the mound, one north and south and the other east and west, and to take all measurements from those. After this first section is made, the work is carried on by slicing; or cutting down about a foot at a time, always keeping a vertical wall in front, the whole width of the mound. Each slice thus made is a section, and whenever the slightest change in the structure is noticed or any object found, that section should be drawn or photographed, and measured as at first, and the exact position noted of any object, ash bed, or change in the character of the structure of the mound. This method is continued until the whole mound has been dug away, and a thorough knowledge of its structure and contents obtained. Such work of course necessitates great labor and is expensive in proportion, but only such a method will give full results; all other methods are partial and consequently of little or no value. In fact unless such work is to be thoroughly done it should not be attempted.

In exploring village sites a trench should be dug through the accumulated leaf mould in order to find the outlines of habitations, and obtain the position of fire-places, refuse-piles, and other signs of occupation. The discoveries thus made should be followed by the removal of surface soil and trenching about the spots. In no case should an excavation be made from the surface of a mound, site of habitation, burnt space, or refuse-pile. From the moment this is done all is in confusion, and much is destroyed by being broken with pick or spade. By trenching and slicing this is avoided, and the sequence of materials, as well as the outlines of habitation, fire-place or refuse-pile can be determined and correctly drawn to scale. In exploring a cemetery a similar method should be followed. A trench should be dug along the edge of the cemetery. Then the area should be marked off on blocks of fifty feet square in order to facilitate making a plan drawn to scale. A "block" should then be dug over to the necessary depth, beginning at the trench and throwing the earth behind, always keeping a vertical section in front, the full width of the block. As each skeleton is reached it is seen in the section. Its position and surroundings should be noted. Every object buried with it will be seen in place, as the earth is removed with a trowel and small hand broom from over and among the bones and objects. In this way the speaker had caused to be excavated burial places, acres in extent, in the Ohio valley, from which most important results had been obtained.

Mr. Putnam concluded his address with an appeal to all archæologists to follow the same principles which are followed in other departments of science and not be satisfied with partial results, but by conscientious and thorough work to aid in the important undertaking of discovering the origin and connections of the ancient Americans, and their distribution and routes of migration over the continent.

On Recent Explorations in Babylonia.

By Dr. William Hayes Ward, of New York.

[Abstract of two lectures delivered in Hopkins Hall, February 18, 19, 1886].

The Wolfe expedition to Babylonia had its origin in the consultations of a few members of the American Oriental Society, interested in Assyriological researches. The necessary funds were given by Miss Catharine L. Wolfe, of New York. I was asked to take charge of the expedition, which it was hoped would require an absence of not more than six months, of which three winter months might be spent in Babylonia. This time was considerably exceeded. Besides myself the party consisted of Dr. J. R. S. Sterrett, of the American School at Athens, and J. H. Haynes, of Robert College. Both these gentlemen were acquainted with the Turkish language, and both had had experience of archæological work in Asia Minor, in search of Greek inscriptions. Our first regions of archæological interest were at the Hittite centres of Marash and Jerablus, the latter of which is the ancient Carchemish. From Marash comes the remarkable lion, covered with Hittite inscriptions, now in the Museum at Constantinople. The mate to it is still on the wall of the Turkish castle at Marash, but is uninscribed. In the immediate vicinity of Marash are the mounds covering several old Hittite towns, which ought to be carefully explored. Numbers of stones with bas-reliefs, of groups of figures and inscriptions, are to be seen built in the walls of Marash, and elsewhere in the vicinity, one of them with the inscription incised instead of raised, as is the case with the

Hittite bowl from Babylon or the Tyana inscription. The material was, in the case of all the stones seen here, or heard of, a black trachyte. We took photographs of all we could get access to. Jerablus is a fine mound covering old Carchemish, on a commanding bluff on the Euphrates, the plain back of which is covered with the thickly scattered ruins of the later Hierapolis. This mound was opened, under direction of the British Museum, by the consul at Aleppo. The inscribed stones discovered by George Smith were sent to the British Museum, but numbers of large sculptures, some of them of the first importance, were left exposed. This is greatly to be regretted, as one or two important ones, in gypsum, are being injured by the atmosphere. Some of them might easily have been transported to England, and the larger ones are well worth the trouble. They were all photographed.

The excavations made in Nineveh and vicinity by Botta and Layard were all visited. At Khorsabad nothing is now exposed to injury, but the head of a colossal human-headed bull, well protected by the earth above it, shows how beautifully the sculpture was done. Koyunjik seems to have been pretty thoroughly explored; but at Nebby Yunus much is yet to be discovered, when the opposition of the Moslems shall be overcome. At Nemrud are long lines of exposed bas relief sculptures, repeating the Standard Inscription of Assurnazirbal, and much more injured by the exposure of these few years than by the thousands of years before they were opened.

In Babylonia nearly all the principal mounds were inspected. The northern, a little above the latitude of Baghdad, includes Akerkuf, with its conspicuous ancient tower, or *ziggurat*, but not otherwise important; then, near the point of outflow of the Sakhlawieh from the Euphrates is Akbar, a mound of the very first importance, not before visited, and which probably represents the Accad of Genesis, and the Agade and Sippara of Annnit of the inscriptions, as well as the Persebora of Zosimus, and the Anbar of the Mohammedan historians. It has been a city of prime importance from the earliest to the latest times (Berosus says five of its kings ruled before the Flood, and here Xisuthrus buried the records of the old world); it is more convenient for excavation, and it is remarkable that it has never before been visited. I must also mention, a little farther north, and on the west of the Euphrates, the large walled ruin now called Jobriya, not on the maps. South of the latitude of Baghdad is Abu-Habba, where Mr. Rassam has done admirable work, and where was the Sippara of Shamash. Tel Ibrahim (Cutha) has been very imperfectly explored. Babylon is so large that it has discouraged scientific explorations, although it has long been ransacked by Arabs, who still dig there constantly, and carry its bricks to Hillah. The northern chief hill called Bab-il, the temple of Bel, does not offer much spoil for excavation, but Kesr and Jimjimeh are more fruitful, and ought to be carefully worked. To the west of the Euphrates is Birs-Nimrûd, with its high vitrified tower and its immense mounds, in part opened by Rassam with considerable profit. To the east of Babylon lies El Ohêmir, slightly explored. From here we pass southward through the middle region of Babylonia, including Zibliyeh, with its fine *ziggurat*, then Niffer (ancient Nipur) one of the largest of the ancient ruins, but quite undisturbed. Near by, to the west, is the fine mound of Delêhem, which we could not visit, and which has never been visited by tourist, but which was a very strong and well-defended city. Farther south are numbers of large mounds, whose ancient names await identification, as Bismya, Dhahar, Hammam, and Fara, all unexplored.

We now reach the southern part of Babylonia, where are Yokha and Umm-el-Akarib, near together, and never visited before, very ancient and important. Crossing to the east of the Shatt-el-Hai, we come to de Sarzec's grand field of exploration at Telloh, where he found the most archaic remains of Chaldean art. He seems to have pretty thoroughly explored, if he has not quite exhausted the locality. Further to the southeast is the equally promising, but unexplored Zerghûl. One party now passed down the Shatt-el-Hai to the Euphrates, and visited, on the west of the latter river, Mugheir, the ancient town of the Chaldees. Messrs. Loftus and Taylor did considerable good work here and at Abu-Shahrein, a few hours to the south, but their work was little more than a beginning. Going northward, up the Euphrates, one party visited the immense ruins of Warka (Erech) where the same explorers did just enough to tantalize scholars. It is second only to Babylon in extent, and hardly equalled by Anbar. No place offers more promise of fruitfulness in antiquities. Beside these mounds should be mentioned Senkereh and Tel Sifr, which we were not able to visit.

The conspicuous objects in such an alluvial country as Babylonia are the lines of the banks of canals and the *tels* which mark the sites of old cities. The cities were, in ancient times, on the banks either of the great rivers, or of the almost equally large artificial canals. These, like the Shatt-en-Nîl, can be traced, and ought to be carefully located on maps. Thus the ancient central canal, now looking like an old road, but called the Shatt-en-Nîl by the Arabs, was followed by us south from Zibliyeh to Niffer, and was reported to us as passing southward, although we did not see it there.

The *tels*, or mounds, are in part the artificial elevations raised for the purpose of serving as sites of the principal buildings of the cities upon them, and in part are the remains of the destruction of the buildings of unburnt bricks, which have fallen during a history of thousands of years. The purpose of erecting such artificial hills would be in part to escape from the discomfort, pestilence, and insects of a periodical marsh, and in part defense and outlook. In the present decayed state of the country one end of a *tel* is often selected as the site of a miserable village; but there exists one admirable example of the ancient earthen acropolis still occupied exactly as of old. At Erbil, the ancient Arbela, the whole summit of the large mound is occupied by the compact city, with the mosques as residences covering the ancient temple of Ishtar of Arbela, surrounded by its strong wall, up to whose gate rises the "ascent," with its steps and inclined way, by which alone the inhabitants, or an enemy, can reach it. The lower city is around the base of the mound.

A considerable trade in Babylonian and other antiquities is still carried on by some Christians and Jews of Baghdad and Telloh. A number of Arabs are kept at work constantly at Jimjimeh and Kesr, making diligent search for tablets, seal-cylinders, and for the later ornaments of gold and other objects found in graves. Besides the objects carried to the British Museum from the late diggings at Abu-Habba and Birs-Nimrud, not a few others were retained, and the British Museum has been compelled to purchase them. Although all exportation of antiquities is forbidden, a good quantity are smuggled out every year, and it would not be difficult to obtain a fine collection by dealing with the men who have charge of this business. Here the lecturer exhibited and described various kinds of antiquities, such as inscribed historical barrels; tablets with contracts, wills, loans, historical records, geographical lists, bilingual hymns, etc.; cylinder and cone seals; rings, and other gold objects. Photographs of the sites of old cities were also exhibited.

Babylonian and Assyrian Archæology. By A. L. Frothingham, Jr.

[Abstract of five lectures delivered in Hopkins Hall, February 25–March 11, 1886].

A glance at the state of knowledge about the history, language, and art of Babylonia and Assyria previous to the last fifty years, shows how modern is the science, and what immense progress has been made since the time when Rollin wrote his standard history, in which he ignored both the existence of an early Babylonian civilization and of Nineveh itself, considering Babylon to be the capital of Assyria. All the Greek traditions, from which our previous knowledge was mostly derived, are fables, if we except the few chronological data derived from Berosus. The only authentic knowledge was that contained in the Old Testament, and that related only to the later Assyrian Empire.

The first steps in the decipherment of the Persian cuneiform inscriptions made by Grotefend and followed up by Lassen and Rawlinson led to the decipherment of the Assyrian characters, on which light began to be thrown shortly before the middle of the century. At this same time Botta and Layard commenced their great excavations in Assyria, that were to revolutionize our ideas of Asiatic art. It is a peculiar feature of Assyriology that here, as with no other nation, history, philology and archæology are inseparable elements that mutually supplement each other. This is even more the case in the present than in the early stage of the study. In Layard's time the main object was the discovery of works of art—palaces and sculptures; no pains were taken to carry away or even save the thousands of inscriptions that came to light in the diggings. Now, when the unparalleled value of these inscriptions is appreciated, they alone are sought for, and but little interest is manifested in the monuments. George Smith found most of the precious documents (including the Creation and

Deluge tablets) with which he enriched the British Museum during his two expeditions, in the same ruins that had been excavated by Layard, at Kouyunjik. As our acquaintance with early Babylonian history increases, the centre of interest is becoming displaced and transferred from Northern Assyria to the more ancient Southern Empire. Until some twenty years ago Assyriology remained, in both its philological and its archæological aspects the specialty of English and French savants. Italy has not even yet joined in the race, but Germany has gradually during the last fifteen years come well to the front in the domain of philology. The school founded by Professor Delitzsch at Leipzig has sent forth, during the last six or seven years, a number of talented young Assyriologists, foremost among whom was Professor Haupt.

The inscriptions have given us the history of Babylonia from a date fixed at c. 3800 B. C. when Sargon I apparently founded the first general Shemitic empire at Agade, probably having been preceded by a period of separate and independent states or cities. Though complete dynastic lists referring to the early period of Babylonian history have been found, their succession has not yet been ascertained for the most part, and, up to the time of Hammurabi, who founded in 2168 an empire on the ruins of Elamite supremacy, we are reduced to a few certain landmarks. After this the outline is well filled and we can follow easily the vicissitudes of the struggle between the Babylonian Empire and the rising power of Assyria. As a whole, Babylonio-Assyrian history is far more interesting than its only rival in antiquity, Egypt, for the latter was isolated through the greater part of its history, while the former empire was always in close contact with the entire East, and its influence reacted even on Greece and Italy.

Among the many problems that have agitated the students of Assyriology that of most moment has been one which affected the entire structure—the problem of the non-Shemitic civilization and language of Babylonia. The term Turanian, applied to them quite generally until late years, was meant to indicate a racial connection with the Ougro-Finnish and Turkish stock; with most scholars this opinion is now considered untenable. That there existed two races in Babylonia, however, from the earliest times is undeniable. Proofs of this are abundant, especially in the mythological and religious writings that have been recovered. The hypothesis of the French scholar, M. Halévy, who contends that the entire civilization of Babylonia was Shemitic and that there never existed any Sumero-Akkadian language, seems improbable on the face of it, though his arguments against the Turanian theory and his strictures on many assumptions of the Sumero-Akkadists have received much attention, and he has made converts of several French Assyriologists. Whatever may be the merits of the case, the share of the Shemites in the early civilization is evidently the principal one.

Archæology. No satisfactory history of Babylonian and Assyrian Art has yet been written. Perrot's work is not a history but mainly a judicious classified description of the works of art uncovered by the excavations. He makes no use of the important help of the inscriptions, and his partial knowledge leads him into the mistake of not recognizing any distinction between the art of Babylonia and Assyria. Until now so few excavations have been undertaken in Babylonia that the monumental history of the long period from about 4000 B. C., to which the first known works date back, up to the ninth century, when Babylonian is absorbed by Assyrian art, cannot be made out even in outline. Neither can the characteristics of the different schools that certainly flourished contemporaneously and successively, be clearly ascertained as yet. We only know that Agade, Ur, Erech, Nippur, Larsa, and Babylon were great artistic centres, and some slight progress has been made in attributing to each one some of the many cut gems whose differences in style are so marked. When these attributions shall have been certified and extended, some light may be thrown on these early schools of Babylonian sculpture. The monumental sculpture, so far as shown by the discoveries of Telloh, has great affinities with Egyptian art, and may even suggest some ethnographical affinities.

As the temple was, in Babylonia, the centre of artistic work, in late Assyrian history this role was played by the royal palaces with which we are so familiar. Both in architecture and sculpture the points of dissimilarity are great between the two civilizations. The Assyrian made far greater use of the arch and vault as well as of the column, than his more Southern neighbor, and in sculpture his exclusive passion was for bas-relief to the entire exclusion of works in the round, for which the Babylonian sculptors showed a marked predilection. The striking contrast both in technique and in conception between the two arts is shown nowhere better than in the seal cylinders belonging to every period and school of Babylonio-Assyrian art, of which several thousand are scattered in the Museums and private collections of the Old and the New World. Although we know of works of Assyrian sculpture that date from the XII cent. B. C., the earliest works of any consequence that have been recovered are the reliefs from the palaces of Assur-nazir-pal (883-58), which are also the finest from an artistic standpoint, and show that the Assyrian sculptor was in full possession of every element of his art. Under succeeding kings this masculine, energetic style became degenerate, and the figures are meaningless and heavy without being strong. Then under Sennacherib arose a new style in which the scenes were treated more pictorially, the figures were smaller and more numerous, and accessories were introduced; great skill was attained in the representation of animal and vegetable life. The perfection of this style was reached under Assur-bani-pal (668).

The artistic relations of Babylonia and Assyria with other nations of the East were varied and important, especially during the height of the late Assyrian Empire, when Nineveh was the great mart of the East and comprised a motley population drawn from all lands. By land the Assyrians traded with Babylonia, Elam, Arabia, and Egypt on the one hand, and with Syria, Armenia and Asia Minor on the other. The early reciprocal influence of Egypt and Babylonia is shown by the remarkable resemblances in the sculptures of Telloh and those of the ancient and middle Egyptian dynasties; then the contact of Assyria with Egypt and the conquest of the latter led to an artistic relationship especially in small transportable works of art. These relations were helped by the Phœnicians. The art of the so-called "Hittites" in Syria and Asia Minor seems to have been strongly affected by Babylonian and afterwards by Assyrian art. The Assyrian influence, however, was apparently limited to the Hittite monuments of Syria proper, where the contact was direct. An inquiry into the influence of Assyrian art shows that this lasted long after the fall of Nineveh. Persia, though her architecture was only partly an offshoot from Assyria, was but her servile imitator in sculpture. The Greek of Asia Minor borrowed much, also; for example the origin of the Ionic order can be traced back step by step to the monuments of Nineveh. A study of the origin of the earliest myths represented in Greek art shows that many of them originated in some form in Western Asia.

The First "Tabular View" of Harvard College, 1642-3. By H. B. Adams.

[Explained in a lecture on "History at Harvard University," Educational Course, J. H. U., February 6, 1886; published in full in *Education*, May, June, 1886].

The earliest account of the course of study pursued at Harvard College, which was founded in 1636, is in a tract called "New England's First Fruits," originally published in 1643, reprinted in parts by the Massachusetts Historical Society in the first volume of its Collections and in full for Joseph Sabin, in 1865. The tract consists of two parts, the first relating to the progress of missionary work among the Indians, and the second to the progress of education in New England, with special reference to Harvard College. The curriculum of study is described in a scholastic way which, at first reading, is almost as confusing to a modern student as the modern elective system would be to a Puritan divine. In order to make the scholastic scheme more easily intelligible, it has been reduced from a descriptive to a graphical form, which, by historical courtesy, may be called the First "Tabular View" of Harvard College.

Among the points worthy of attention in this curriculum are: (1) The course of study was for three years and was arranged for the so-called First, Second, and Third Classes. The First *Classis* was of Third-year men. (2) The attention of each class was concentrated for an entire day upon one or two studies, with "theory" in the forenoon and "practice" in the afternoon. (3) Monday and Tuesday were devoted to Philosophy, including Logic and Physics for the First year; Ethics and Politics for the Second year, with Arithmetic, Geometry, and Astronomy for the Third year. All this work was done in morning hours. In the afternoon came philosophical disputations for each class in its own field of study ("every one in his art"). (4) Wednesday was Greek day for all classes. First-year men studied Etymology and Syntax in the forenoon and practiced the rules of

Grammar in the afternoon; the Second Class studied Prosody and Dialects from 9 to 10 A. M. and practised "in Poesy" after dinner; Third-year men did likewise in the theory and practice of Greek composition, prose and verse. (5) Thursday was devoted to "the Eastern tongues," with the theory of Hebrew, Chaldee and Syriac Grammar in the morning and practice in corresponding Biblical texts in the afternoon. (6) Friday was given up to Rhetoric. All students were taught the principles of Rhetoric and all were required to practice English composition, and once a month to declaim. (7) Saturday, at eight o'clock in the morning, all the students were taught "Divinity Catecheticall," and, at nine o'clock, "Common Places." *

(8) The last and least place in this otherwise excellent curriculum was given to History and Nature. At one o'clock, Saturday afternoon, immediately after the twelve o'clock dinner, and at the fag end of the week, the students were taught History in the winter and the Nature of Plants in the summer. *Historia civilis* and *Historia naturalis* were close companions in all early academic courses, and they have remained associated in some American colleges down to very recent times. At Harvard, History and Botany were probably consorted upon scholastic grounds, but it is interesting to note that the summer season was assigned to Botany, thus implying botanical practice as well as theory. (9) The absence of Latin from the entire plan of study is noticeable and is explained by the fact that students were required to speak Latin in the class-room and in the college-yard. Latin was the main requirement for admission to Harvard College. The rule was: "When a schollar is able to understand Tully [Cicero] or such like classicall Latine author extempore and make and speake true Latine in verse and prose, *suo ut aiunt Marte;* and decline perfectly the paradigim's [sic] of nounes and verbes in the Greek tongue: Let him then and not before be capable of admission into the Colledge." Such classical preparation was given to boys by the ministers in and about Cambridge, who were well-educated Englishmen and talked Latin with their pupils. There was also by the College "a faire Grammar Schoole, for the training up of young schollars, and fitting of them for Academicall learning." (10) The relative importance of the various branches of academic discipline, as indicated in this original curriculum of Harvard College, appears to have been as follows: First, Philosophy (Logic and Physics, two hours; Ethics and Politics, two hours; Disputations, six hours) altogether, ten hours a week. Greek came second, occupying, with New Testament Greek, seven hours. Rhetoric (the writing and speaking of the mother-tongue) enjoyed the third place of honor, employing six hours. Oriental languages held the fourth place, occupying five hours a week. Mathematics stood next in order, with two hours. The catechism and common places were equally favored with an allowance of one hour. History and Botany were put on half-allowance, each with one hour a week for a half-year. (11) Altogether in the scholastic week at Harvard College, in 1642–3, there were thirty-three hours of theory and practice, averaging eleven hours a week to each class. (12) Saturday afternoon was a half-holiday, except that the first hour of it was improved by the college, possibly with the hope that after an introduction to History in winter and to the Nature of Plants in summer, students would further improve these fields of study during the remainder of the afternoon.

The following rules with reference to examinations and the bestowal of degrees in early Harvard are not without interest:

"The summe of every lecture shall be examined, before the new lecture be read."

"Every schollar, that on proofe is found able to read the originals of the Old and New Testament into the Latine tongue, and to resolve them logically; withall being of godly life and conversation; and at any publick act hath the approbation of the Overseers and Master of the Colledge, is fit to be dignified with his first degree."

"Every schollar that giveth up in writing a System, or Synopsis, or summe of Logick, naturall and morall Philosophy, Arithmetick, Geometry, and Astronomy: And is ready to defend his Theses or positions: Withall skilled in the Originalls as abovesaid: And of godly life and conversation: And so approved by the Overseers and Master of the Colledge, at any publique act, is fit to be dignified with his 2d degree."

* These latter were common topics of scholastic discussion and digests of doctrine, argument or opinion. In a cyclopædia of the sciences, published at Lyons in 1649, all branches of knowledge are treated under the head of *Loci Communes*, in special chapters, with such titles as *Loci Ethici, Loci Oeconomici, Loci Politici, Loci Theologici, Loci Jurisprudentiae, etc., etc.* Lord Bacon in the fifth book (cap. 5) of his Advancement of Learning says "there can hardly be anything more useful even for the old and popular sciences, than a sound help for the memory; that is a good and learned digest of Common Places. I am aware indeed that the transferring of the things we read and learn into common-place books is thought by some to be detrimental to learning, . . . ," but says Bacon "I hold diligence and labour in the entry of common places to be a matter of great use and support in studying." Thus we see the connection between the mediæval idea of a well-ordered digest of knowledge and the modern common-place book or note-book.

"The times and order of their Studies unlesse experience shall shew cause to alter."

Days of the Weeke.	8th Houre.	9th Houre.	10th Houre.	1st Houre.	2nd Houre.	3rd Houre.	4th Houre.
	First Yeare.	Second Yeare.	Third Yeare.		First Yeare.	Second Yeare.	Third Yeare.
2nd Day.	Logick first three quarters. Physicks last quarter.	Ethicks and Politicks at convenient distances of time.	Arith. & Geom. three first quarters. Astronomy the last.		Disputes.	Disputes.	Disputes.
3rd Day.	ditto.	ditto.	ditto.		ditto.	ditto.	ditto.
4th Day.	Greeke, Etymologie and Syntax.	Greeke. Prosodia and Dialects.	Greeke. The 3rd yeare perfect their theory before noon.		Greeke. Practice the precepts of Grammar.	Greeke. Practice in Poesy, Nonnus, Duport, or the like.	Greeke. Exercise style, Composition, Imitation both in prose and verse.
5th Day.	Hebrew Grammar.	Chaldee.	Syriack.		Practice in the Bible.	Ezra and Daniel.	Trestius' New Testament.

General Exercises for all Classes.

6th Day.	Rhetorick to all at the 8th houre.	Declamations. Every schollar once a monthe.	The rest of the day		*vacat* *	*Rhetoricis*	*studiis*
7th Day.	Divinity Catecheticall to all.	Common Places to all.		History in the winter. The Nature of Plants in the summer.			

[* *Vacat* is here used in the sense of *is reserved for* rhetorical studies.]

REPORTS OF RECENT COMMUNICATIONS TO THE UNIVERSITY SOCIETIES.

The Correlation of *v* and *m* in the Veda. By M. BLOOMFIELD.

[Abstract of a paper read at a meeting of the University Philological Association, January 8, 1886].

Ascoli, in his excellent treatise on the Prākritic change of *m* to *v*, broaches occasionally the question of the existence of a corresponding change in Sanskrit—he does not refer to the Vedic dialect—and it seems to me that his reference to this point does not do justice to the state of the case. The following remarks are intended to supplement his paper by pointing out: 1. That there are very distinct traces of a correlation of the two sounds in the Vedic and classical dialects; 2. That this correlation is not restricted to the change of an *m* to *v*, but that the converse movement occasionally takes place.

Vedic *urvarā*, "field of grain" (*ἄρουρα*), yields later *ūrmilā*, personified in the Rāmāyaṇa as the sister of *sītā*, "the furrow." In Pār. Gṛ. Sū. ii. 17, 9 (Cf. Weber, Ind. Stud. ii, 392; Omina and Portenta, 373, note 2), the ploughing-festival is described, and accordingly divinities of the field and the plough are called upon for their aid. First in the list are *urvarā* and *sītā*. When later, in the Rāmāyaṇa, *ūrmilā* turns up in the story as the sister of *sītā*, it seems imperative to regard *ūrmilā* a development from *urvarā*, and I would see in it a diminutive formation from *urvarā*, in which the *u* has been lengthened secondarily by popular etymology (*ūrmi*, wave; *ūrmilā*, "the wavy field").

A purely Vedic example is contained in *srāma*, "snot," if we compare it with *srāva*, "rheum." The latter is a common word. The former occurs in Kāty. Çr. Sū. xx. 3, 13, glossed by two scholiasts with *çiṅghāṇaka*, "snot," *srāmaḥ, siṅghānaka (!) ucyate* and *srāmaḥ siṅghāṇakaḥ çālihotre prasiddhaḥ*. Cf. Ind. Stud. iv. p. 426.

Another Vedic example is √*çmañc*=√*çvañc*, "to spread." It occurs in the Tait. Āraṇyaka. See Whitney, Roots, Verb-forms, etc., p. 181.

Yāska's disquisition upon *çmaçānā*, Vedic and Sanskrit for "cemetery," seem to me to contain by implication a proof for the interchangeableness of *v* and *m* in the time of the composition of the Vedic grammars, *i.e.*, probably before the time of Pāṇini. Nirukta, 3.5, we have the following etymology for this word: *çmaçānam, çma-çayanam, çma çarīram*. What can this *çma*=*çarīram* be? Yāska himself seems puzzled by this construction. He regards it as an *n*-stem *çman*, and operates with it further on in explanation of *çmaçru*, "beard;" *çmaçru loma çmani çritam*. I regard this as a most interesting case in which Yāska, the oldest etymologist, has inherited and misunderstood the material of an older etymologist, who either saw what in fact may be the real state of the case, or at any rate had in mind a much more sensible explanation of this *çma*, be it ultimately found acceptable or not. *Çmaçānā* is oxytone; the supposition that short *a* has fallen out in the first syllable owing to this accentuation is natural. If we, therefore, substitute **çva-çānā* for *çma-çānā* and suppose that an *a* has fallen out in the first syllable, we arrive at *çava-çayanām*, "resting place of a corpse," as an explanation of the word, which might well have been offered by a Hindu etymologist. But Yāska misunderstood the intention of his predecessor as far as the *çma* was concerned, and mechanically construed the *n*-stem *çman*. I do not quite venture to offer Pāli *susāna*, which presupposes **svasāna*, in support of the actuality of the supposed **çvaçāna*, as the later vernaculars offer instances of a development somewhat similar to that of Sk. *çmaçāna:* Pāli *susāna*, e.g., Sindi *surti* = Sk. *smṛti*, etc. Cf. Ascoli loc. cit. pp. 208, note 22, and 222, note 43.

For *vrandin*, "making slack" (Rv. i. 54, 4, 5), Yāska, Nirukta, 5. 15, has the following explanation: *vrandī vrandater mṛdubhāvakarmaṇaḥ*. Roth, on p. 60 of his "Erläuterungen," remarks: "Root *vrad*, as indicated by Yāska himself, is without doubt a variant of root *mrad, mṛd*." Even if that be not absolutely certain, we may at least take it for granted that Yāska had this derivation in mind, so that there appears at least to have been no doubt in Yāska's mind about the interchangeableness of the two sounds.

Tāit. s. ii. 1, 4, 3 reads: *sa yamó* devānām indriyám *ayuvata*, tad yamásya yamatvám, and Kāuç, 128, 4, we have *çarva* and *çarma* in alliteration with one another in a verse constructed with special reference to alliteration: *somo* rājā *savitā* ca rājā *bhuvo* rājā *bhuvanaṁ* ca rājā | *çarvo* rājā *çarma* ca rājā ta u naḥ çarma yachantu devāḥ.

The influence of this similarity of the two sounds is vigorously at play in Vedic and Sanskrit MSS. My own collection hails largely from the literature of the Atharva-Veda. No doubt, the critical apparatus of every Vedic text would yield fresh materials in illustration of this correlation of sounds. Kauç. 3, 8 and 137, 36 the MSS. read: ya ud udvataḥ (Var. yad udvataḥ) *unnimataḥ* (Var. unnamataḥ, unnibataḥ) çakeyam. I have taken into the text yad ud udvataḥ *un nivataḥ* çakeyam (cf. TS. iii. 2, 4, 4), and expressed the belief that the MSS. represent collectively a syncretism of the accepted reading with another version: yad udvataḥ *unnamataḥ* çakeyam. In any case the writings of the MSS. are explainable only on the ground of the great similarity of the sounds.

AV. xix. 42, 3, there is *sutrāmne* as var. of *sutrāvne*; Vāit. Sū. 13, 16, and Gop. Br. ii. 2, 3 read *çakmane*, while VS. v. 5 reads *çakvane;* Kāuç. 89, 1, four of seven MSS. read *manvabhiḥ* for *manmabhiḥ;* Kāuç. 65, 15, four of seven MSS. read *devātvā* for *devātmā;* Kāuç. 60, 19, two MSS. read *manthantām anumantrayate* for *manthantāv anu°;* Kāuç. 71, 1, there is the hemistich, aṅço rājā vibhajatī 'mām (! all MSS.) *agnī* vidhārayan, where sense is obtained by emending to *'māv agnī;* AV. iii. 10, 10, the MSS. are divided between the correct reading *samṛ́dhe* and *savṛ́dhe;* AV. xii. 1, 2, many MSS. read *madhyatas* for *badhyatas;* xix. 31, 11, the vulgata reads *ávartim* for *ámṛtam* of the MSS.; xix. 35, 5, the edition has *mártyebhyas* for *vabhṛtenyàs* of the MSS.; Pār. Gṛ. Sū. i. 16, 24, *çyāvaçabalau* occurs as a variant to *çyāmaçabalau*; Çāṅkh. Gṛ. iii. 10, 2, *çravo* occurs as var. to *çrama*. I have also noted *mīkṣate* as var. of *vīkṣate* from some Vedic text.

From the later language I have at hand in addition to the cases cited by Ascoli, *çravaṇa* and *çravaṇā*, "male and female begging monk," for *çramaṇa* and *çramaṇā; açvanta* in Hemacandra's Anekārthasaṁgraha as variant for *açmanta; açvaka* and *açmaka* are variants of the same proper name; *açmala* occurs as a var. for *açvaka* in Vopadeva; *yamadvīpa* and *yavadvīpa* are varying names of the same island; *yamanikā* occurs as var. of *yavanikā*. For all these see the Pet. Lex. Inscriptionally the name *Govinda* occurs as *Gominda*; see Bühler Vallāhī grants, xvi. (Indian Antiquary); the *Atharva* Veda is now called *Atterman*-Veda in Kashmīr (see Roth, Der AV. in Kaschmir, p. 11). The last two examples are especially interesting, as they exhibit in an incontrovertible form the change from *v* to *m*, which Ascoli treats with scepticism. The root *hmal*, mentioned by Ascoli, is fairly well authenticated as equivalent to root *hval*. It occurs in the *dhātupāṭha*, Pāṇini, Vopadeva, and twice in the schol. to the Ath. Prātiçākhya; both are explained in the *dhātupāṭha* by *gatau, calane*. Çiçupālavadha, 9, 24, the reading *samavabodhiṣata* is to be emended in accordance with the explanation of the schol. to *samam* abodhiṣata.

The Origin and Settlement of the Pennsylvania Germans. By M. D. LEARNED.

[Abstract of a paper read at a meeting of the University Philological Association, March 5, 1886].

The object of the paper is to ascertain the origin of the German settlers of Pennsylvania and thus determine the linguistic elements brought by them to that Province and afterwards developed into the unique speech known as "Pennsylvania German" (Pennsylvanisch Deutsch). The subject, while of peculiar interest to the linguist, has for the student of American history and institutions an importance too often overlooked. No State of the Union, perhaps, offers more interesting phenomena in social history. Here may be seen representatives of almost every stage of our national development; the man of modern culture, and within sight of his dwelling the crude, honest, industrious Pfälzer and Swiss wearing the dress of two centuries ago, happily indifferent to the march of science, literature or art, observing the customs of his forefathers on the banks of the Rhine. It is in the midst of such a civilization that we are to seek the causes giving rise to this important speech-island in the domain of German dialects.

After giving a historical sketch of the early German settlements in other parts of the country, the writer considers the German colonization of Pennsylvania in two periods: (1) that of colonization proper (1682–1750),

(2) that of migration interspersed with direct colonization (1750–circa 1800).

As causes of the great influx of Germans to America during the first period, two groups of facts present themselves: (1) the generally unsettled political condition of Germany, (2) the results of Penn's travels in that country. Under the first, are to be emphasized the ravages of Louis XIV in the Rhine-Pfalz and the expulsion of 500,000 Huguenots from his realm by the revocation of the edict of Nantes. Under the second, are to be mentioned the acquaintances made by Penn in meeting the Quakers of Holland, Hamburg, Lübeck, the Pfalz, and other parts of Germany at Amsterdam, the organization of the Frankfurt Land Company, and the inducement offered to Crefeld merchants to purchase land in Pennsylvania.

The first organized German settlement in Pennsylvania was made by Crefelders under Franz Daniel Pastorius, at Germantown, 1683. In 1694 came the "Erweckte" (awakened) under Johann Kelpius and settled "Das weib in der wüste" on the Wissahickon. From 1704-12 settlements were made in Oley, Berks County, by English Friends, French Huguenots, and Germans from the Palatinate. In 1712 land was purchased in Eden in the present Lancaster County and settled by emigrants from the cantons of Zürich, Bern and Schaffhausen. They had gone to the Rhine country above Strassburg in 1672, from the Rhineland to England 1708 and thence to Pennsylvania. Their settlement at Eden (Pequea Thal), Lancaster County, was soon increased by other Germans (probably mostly Pfälzer) and Swiss. In 1716 large German settlements were made in the present Berks and Montgomery Counties. In 1719 Schwartzenau Täufer (Baptists) under Peter Becker settled on the Shippack in Oley, Berks County, and on the Conestoga and Mühlbach, in Lancaster County. In 1723 a company of Pfälzer from Schoharie, N. Y., settled at Tulpehocken, Berks County. These last were joined in 1729 by Conrad Weiser with an accession of emigrants from the Palatinate. In the same year Palatines settled at Quintaphilla and German Jews at Schäfferstown, Lebanon County. In 1730 a Dutch settlement was made in Pike township, Berks County. In 1734 Hereford township and adjoining land in Montgomery and Lehigh were settled by Schwenkfelders. Moravians from Herrnhut, Saxony, having left their settlement made in Georgia in 1734, came to Pennsylvania and began to build Bethlehem in 1741. Four years later the remaining Georgia Moravians came to Pennsylvania and settled in the counties around Bethlehem. Reading was settled 1748 by Würtemburgers and Palatines.

The second period, that of migration, began before 1730. In the entire Kittatining Valley the Germans have supplanted to a great extent the Scotch-Irish. This is especially the case with the Counties of York, Lancaster, Franklin, Adams and Cumberland, a fact due in part, doubtless, to the native antipathy of the two races; but not a little to the open feud brought about in the Cressap war in 1736. The line of migration and settlement follow the march of the advancing Scotch-Irish into the northern and western portions of the State.

By considering the number, distribution, social, political, intellectual and religious character and aims of the German settlers thus traced in various parts of the State, we shall find the causes of the dialectic phenomena of these people. At the end of the seventeenth century the Germans in Pennsylvania were estimated at 200 families; in 1750, at about 90,000 persons; and in 1800, at about 150,000. Many of the Pennsylvania Germans are to be found to-day in the larger cities, as Philadelphia, Reading, Harrisburg and others, where it is possible to find all shades of dialectic difference; but the distinctively Pennsylvania German speech is to be sought in the country districts and towns. From the foregoing historical examination, we have the following results contributing to the formation of this speech:

In Germantown the border dialect between Low Fränkish and Rhine Fränkish brought in by the Crefelders; the Rhine Pfälzish of the Palatines and the South Fränkish near the Alemanic borders; in Berks County, Rhine Pfälzish and French peculiarities brought in by Palatines and French Huguenots; at Tulpehocken, Rhine Pfälzish introduced by the Schoharie Palatines and their countrymen direct from Germany; in Bern, Swiss (Alemanic) elements; in Brecknock, Caernarvon and Cumrn townships, Welsh; in Union township, Swedish, English, Welsh; in Pike township, Dutch; in Hereford township and adjoining portions of Montgomery and Lehigh counties, Silesian peculiarities brought in by Schwenkfelders; in the neighborhood of Eden, (Pequea Thal) Lancaster county, Swiss (Alemanic) and the dialectic characteristics of Schwarzenau, Marienborn, Schlechtenboden, as well as of the leading towns and villages of the Rhine Pfälz; about Bethlehem, the Upper Saxon dialect represented by the Moravians of Herrnhut; in and around Reading, the peculiarities of Würtemburg and the Palatinate.

These dialectic characteristics were brought over by Germans who were men from the humbler walks of life, of firm convictions, strongly imbued with the earnest Pietistic spirit of the time, cherishing the traditions of the Fatherland, caring little for political distinction, content to till the soil unmolested in their religious and social life. If to these facts favoring the retention of the original speech, we add that, besides the printing of German newspapers in the larger towns at a later date, printing presses were established early in the eighteenth century, at Germantown and Ephrata, from which periodicals of various descriptions were distributed in great numbers to the reading public, we shall find the development of a peculiar German speech the necessary result.

The Dialects of North Greece. By Herbert Weir Smyth.

[Abstract of a paper read at a meeting of the University Philological Association, April 2, 1886.]

This paper aimed at presenting a comprehensive sketch of the tribal relations of the Greeks occupying the district north of the Corinthian gulf, with the exception of the Megarians and Athenians, together with a complete summary of the peculiarities of the idiom of each canton, in the endeavor to establish definite centres of dialect life. The conclusions reached in reference to the dialect of Western Greece were based upon the first exhaustive examination of the inscriptions of Epirus, Acarnania, Aetolia, of the Aenianes and of Phthiotis, that has hitherto been made.

The statement of Strabo—that all the Hellenes north of the Isthmus, except the Megarians, the Athenians and the Dorians settled about Parnassus, were in his time called Αἰολεῖς—finds no support in the epigraphical monuments. The dialects of Thessaly and, with some limitations, that of Boeotia, alone deserve the epithet "Aeolic." Despite many patent cases of similarity between the idioms of these two cantons, there exist certain radical differences, which dialectologists have not satisfactorily explained. This divergence between these two dialects consists in the greater number of Doric ingredients in the Boeotian idiom. It has been assumed that these Dorisms are either survivals of an Aeolo-doric period or of the speech of the inhabitants of Boeotia prior to the so-called invasion of the Boeotians from Arne in Thessaly.

This paper, while endeavoring to prove the indefensibility of each of these theories, maintained that the original inhabitants of Boeotia were of Aeolic, the invaders of Doric stock and that to the influence of the latter is due that generous admixture of Dorisms, which constitutes one of the peculiarities of the Boeotian idiom.

The testimony of the ancients offers no cogent support to the theory that the invaders were of Aeolic blood, the statement of Thucydides, I. 12, being evidently a make shift to establish an external harmony between his account and that of Homer, who recognizes Boeotians as inhabitants of Boeotia. On the other hand, we have no inconsiderable mass of testimony (hitherto not placed in its proper connection) proving the Aeolic character of the original settlers. Athamas the son of Aeolos was king of Erchomenos the city of the Minyai, who were bound by municipal ties to Iolcos in Thessaly, the γῆ Αἰολίς of the ancients, and who had settlements in Thessaliotis. It is not beyond the range of probability that the Minyai were originally settlers on the Pagasaean gulf, that they emigrated thence to the Copæic valley and in fact that Boeotia and Thessaly formed before the Trojan war one territorial district. The similarity of the ancient worship of the two cantons, the recurrence of the same geographical designations and many other elements of resemblance, which cannot be merely incidental, make for the conclusion that originally Aeolic was the vernacular throughout the Eastern portion of North Greece.

The Minyai, expatriated by the irruption of the Dorians, fled to Lemnos and settled eventually in Elis. The conjecture of Fick in reference to the origin of the admixture of dialects in the Elean speech through Minyean influence can justly assert a high degree of probability, since it alone explains satisfactorily the existence of such Aeolic ingredients as the ψίλωσις, the accus. plur. in -αις and -οις (-αιρ, -οιρ), which no sound criticism can establish either as importations from Arcadia or as the result of isolated

and spontaneous evolution. The North Greek Dorisms of this dialect are to be referred to the influence of the Aetolian settlers. The term Αἰολεῖς Βοιωτοί, applied to the Boeotians, has been correctly explained as being equivalent to Αἰολεῖς—the orlginal inhabitants—καὶ Βοιωτοί—the later immigrants.

Thessaly, the home of the Aeolic Achilles, was the abode of a people destined to give birth to the epopee. Hence this race of vigorous intellect was better able to resist the encroachment of the speech of the Dorian conquerors under Thessalus than the weaker, though kindred, Boeotians. In Thessaly, therefore, we meet with but few Dorisms (ἐν for εἰς, ποτί, κράτος, etc.); in Boeotia, however, while frequent Aeolisms indicate the existence of an Aeolic substratum (inf. in -έμεν, datives in -εσσι, etc.), the Dorisms are more plentiful (ἱαρός, accus. pl. in -ως, ει<η by compens. lengthening, ἀπό for Aeolic ἀπύ, ἀν for ὀν, κά, etc.)

The dialects of Western Greece disclose a genuine *proletariate* of speech, which, with occasional epichoristic variations, is all of one type. The Phthiotic idiom is so closely allied to that of Aetolia, all powerful at the period of the supremacy of the Aetolian league, that we cannot doubt but that the latter has supplanted the vernacular, which was homogeneous with that of the other provinces of the Thessalian τετραρχία. The following are a few of the peculiar forms of the Western Greek type:—ἐνήκοντα, once in an Oetean inscription, θεαρός and θεωρός, Διοπέθης εἰάν, each once in the dialect of Epirus, non-contraction of εα, εο, εω, dat. plur. in -οις (cons. decl.) ἐν for εἰς, γέν for γέ once in Epirus. The inscriptions, which open up this perspective of dialect life are unfortunately of so late a period, that it is well-nigh impossible to reëstablish the ancient coloring of the native speech. The oldest Epirotic inscription dates from between 342–326 B. C., the Acarn. inscriptions date from 200, the oldest Aetolian between 249 and 189; none of the Phthiotic monuments antedate the period of the incorporation of Phthiotis in the Aetolian league. A generous wealth of forms is displayed in the dialect of Locris and Phocis, that of the former especially preserving the oldest known type of North Doric. It contains peculiarities, which may be conjectured to have been the common heritage of all Northern Dorians, since the Aetolians at the time of the return of the Heracleidae infused into the Elean speech phenomena found later in the Locrian dialect alone. The Delphic inscriptions represent an older linguistic stage than those of the rest of Phocis; F is found three times (κλέFος αἰFεί Fέξ) in Delphic territory, once in Phocis (Fανακείωι).

The complete collection of material, which was the substructure of this paper, affords a survey of the entire development of North Greek speech, and justifies a division of the entire territory into two linguistic centres. I. The Eastern, or Aeolic, comprising the dialect of Thessaly and that of Boeotia, with its stronger intermixture of Dorisms. II. The Western or pure North Doric division. The interlying cantons, though essentially North Doric, are colored by the adoption of certain loan-forms from the East, the extension of which can be traced with great precision. So, for example, the dat. pl. -εσσι has not succeeded in pushing its westward course beyond the boundary of Phocis and Locris. Other Aeolisms (Δρυμιεύς, Πηλεκλέας, ἐνκαλείμενος) are to be explained as importations and not as survivals of an Aeolo-doric period. Those dialectologists have committed a grave mistake, who regard the use of ἐν cum accus. and πέρ for περί as Aeolisms. The former is North Doric, the latter, though sporadic, is not confined to the limits of a single family of dialects.

Finally, the necessity of exact chronology in the investigation of dialectical phenomena was insisted upon and it was shown that the dialectologist can steer a middle course between the "Stammbaumstheorie" of the Darwinist Schleicher and the "Wellentheorie" of Johannes Schmidt or Paul Meyer. If linguistic phenomena alone be taken as the point of departure in dialectology the possibility of limited speech-centres is unduly weakened. Areas of greater or less extent must have existed in which originally "dialects" held sway; these areas need not be co-extensive with those resulting from political division, nor are they free from disintegration through the influence of neighboring speech-areas and of self-generated forms.

The Malarial "Germ" of Laveran. By Geo. M. Sternberg.

[Abstract of a paper read before the University Scientific Association, March 3, 1886].

Laveran, a medical officer of the French army, as a result of extended researches made in Algeria, announced, in 1881, the discovery of a parasitic micro-organism in the blood of patients suffering from malarial fever. His observations led him to the conclusion that the organism in question is found only in the blood of malarial fever patients, and that it is directly concerned in the etiology of these fevers. The parasite is described as presenting itself under several different forms and as being sometimes endowed with active movements, due to the presence of several motile flagella. This, however, was exceptional, and it was commonly observed as an amœboid organism which contains in its interior granules of black pigment.

The organisms were found most abundantly at the outset of a malarial paroxysm, and were partly free, and partly *attached* to the red blood corpuscles. They disappeared from the blood when quinine was administered in effective doses. These observations were confirmed by Richard, in 1882, in a communication made to the French Academy of Sciences. More recently, additional confirmatory evidence has been furnished by two Italian investigators, Marchiafava and Celli, who have made extended researches in the *Santo Spirito* hospital of Rome. They find that during a malarial paroxysm blood drawn from the finger of the patient constantly contains an amœboid parasite in considerable numbers. This is found for the most part *in the interior* of the red blood corpuscles, and may or may not contain pigment granules.

During a recent visit to Rome Dr. Sternberg accompanied the gentlemen last referred to, to the *Santo Spirito* hospital, and a most satisfactory demonstration was made to him of the presence and amœboid movements of this parasite, in blood drawn from the finger of a patient in the first stage of a malarial paroxysm.

As the result of numerous microscopical examinations made during the past two years Marchiafava and Celli confirm Laveran as to the constant presence of this amœboid organism in the blood of patients suffering from malarial fever, and as to its disappearance under the administration of quinine. They have not been able to find the parasite in the blood of patients suffering from other diseases.

This organism appears to be identical with the "hyaline bodies," usually containing pigment granules, which are found in the interior of the red blood corpuscles, in the capillary vessels of the brain and other organs, in fatal cases of "pernicious fever."

Finally, Marchiafava and Celli have induced typical attacks of intermittent fever, in previously healthy persons, by injecting into the circulation a small quantity of blood drawn from a malarial patient during a paroxysm of fever. The presence of the parasite was demonstrated in the injected blood, and it was found again in the blood of the persons subjected to the experiment during the induced intermittent paroxysms. These paroxysms were arrested and the parasite disappeared from the blood when quinine was administered.

PUBLICATION AGENCY OF THE JOHNS HOPKINS UNIVERSITY: NOTICE AS TO RECENT PUBLICATIONS.

Photograph of the Normal Solar Spectrum. Made by Professor H. A. Rowland.

By reason of the prolonged season of unfavorable weather during the months of February and March, the work of the photographer on the plates of the solar spectrum was greatly delayed. It is now well advanced and the orders of subscribers will be filled at an early day. The subscriptions already received exceed the contemplated first edition. Another edition will, however, be ready by July 1st. Subscription to the set of seven plates, mounted, is $12; unmounted, $10. A prospectus will be sent on application.

Reproduction in Phototype of a Syriac Manuscript with the Antilegomena Epistles. Edited by Isaac H. Hall.

The issue of this work is limited to 250 copies in all, and half of this number has already been taken up. Seventeen pages of the MS. have been reproduced by the phototype process, and an introduction and brief notes have been added by the editor. The price is fixed at $3. A few copies will be bound in cloth and sold at $4.50. A prospectus will be sent on application.

LIST OF BOOKS AND PAPERS WRITTEN BY PROFESSOR C. D. MORRIS.

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On the rights of a Greek metropolis over its allies. Johns Hopkins University Circulars, Vol. III, No. 29, 1884.
On K. Brugmann's recent grammatical studies. Johns Hopkins University Circulars, Vol. III, No. 32, 1884.
On the financial history of Athens. Johns Hopkins University Circulars, Vol. IV, No. 36, 1885.
On Krueger's chronology of the so-called "Summary" of Thucydides. Johns Hopkins University Circulars, Vol. V, No. 45, 1885.

Unpublished MSS.

A popular lecture entitled "Roman Society in Juvenal."
A paper on Lucian's Ὄνος and Apuleius.
A paper discussing Kirchhoff's Herodotus.
An academic lecture on Translations.
Translations in English of the following:
Euripides, Bacchae.
Euripides, Ion.
Persius.
Thucydides II and III..
A book of Homer's Iliad.

PROCEEDINGS OF SOCIETIES.

Scientific Association.

April 7.—Seventy-first regular meeting. Professor Remsen in the chair. Forty-five members present.

Papers read:
Recent Advances in our Knowledge of the Visceral Nerves, by H. N. Martin.
Measurements of the Absolute Wave Lengths of Light, by Louis Bell.
Chemical Action in a Magnetic Field, by I. Remsen.

May 5.—Seventy-second regular meeting. Professor Remsen in the chair. Thirty-five members present.

Papers read:
A Study of Psychological Time, by G. S. Hall.
Some Optical Properties of Metal Films, by A. L. Kimball.
Proof of a Theorem of Eisenstein's, by F. Franklin.

Philological Association.

April 2.—Sixty-ninth regular meeting. Professor Gildersleeve in the chair. Thirty-six members present.

Papers read:
On the Dialects of North Greece, by H. W. Smyth. (*Abstract on p.* 94.)
Contributions to the Exegesis of the First Book of the Atharva-Veda, by M. Bloomfield.

May 7.—Seventieth regular meeting. Professor Gildersleeve in the chair. Forty-five members present.

Papers read:
On four unpublished White Lecythi from Athens, by Professor J. H. Wright, of Dartmouth College.
On some points of Intonation and Quantity in English, Norse, and German, by A. E. Egge.

Historical and Political Science Association.

March meetings.—Dr. H. B. Adams in the chair.

Papers read:
The Contents of the Bluntschli MSS., by J. M. Vincent. (*Abstract on p.* 59.)
The National Bureau of Labor, by E. R. L. Gould.
The Study of American History in our Schools and Colleges, by F. N. Thorpe.
National Aid to Education, by W. H. Gardiner.

April meetings.—Dr. H. B. Adams in the chair.
Willem Usselinx, Founder of the Dutch and Swedish West India Companies, two Papers, by J. F. Jameson.
The Reform of Railway Abuses, by R. T. Ely.
The Origin of the "Mace," by E. Leyh.
The Nature of the Railway Problem, by R. T. Ely.
The Economic Aspect of Administrative Reform, by Dorman B. Eaton.

Mathematical Society.

April 8.—Professor Newcomb in the chair. Eight members present.

Papers read:
On the Combination of Errors, by S. Newcomb.
An Equation in Finite Differences, by W. E. Story.
Note on Binomial Linear Differential Equations, by T. Craig.
Generalization of Two Theorems, by D. Barcroft.
A Method of Solving Riccati's Equation, by J. C. Fields.

Baltimore Naturalists' Field Club.

The regular monthly meetings of the Field Club have been continued through the past winter, and papers have been read as follows:

January 20.—Seasonal Dormancy of Animals, by H. H. Donaldson.
List of Molluscs of Baltimore, by O. Lugger.

February 17.—Earthworms, by E. A. Andrews.
Classification by means of Phyliogeny, applied to the Stomatopods, by W. K. Brooks.

March 17.—Recent work on the Physiology of Chlorophyll, by W. H. Howell.
Nutrition of Gasteropod Embryos, by J. P. McMurrich.

April 21.—Mr. Arthur reported on the field work of the Botanical Section. Upwards of 50 species of plants had been found in blossom up to date. Symplocarpus foetidus was found in bloom February 28th, near Catonsville, by Mr. Sollers.
Mr. Sollers described a purple variety of the flower, which he found growing with the common form. This was figured and described by Barton as a distinct variety in his Medical Botany, published in the early part of the century, but no recent notice of it has been found.
Mr. Bayley said that some very good specimens of Haydenite had been recently discovered near Baltimore.
Dr. McMurrich exhibited specimens of two species of Planariana, one of which had deposited its cocoon of eggs while in captivity.
Dr. Barton described an interesting case of bees visiting the flowers of the Southern yellow jessamine (Gelsemium sempervirens ait), in bloom in Baltimore. In its Southern habitat, it is said, that bees do not visit it. The toxic effect of the honey, which was obtained by piercing the corolla-tube, was immediate, producing partial, and total stupor and finally death. Thus it seems that insects learn to avoid poisonous plants only by experience.

RECENT ACCESSIONS TO THE UNIVERSITY LIBRARY.

(This list includes the principal bound volumes recently received, but does not comprise pamphlets or the current numbers of periodicals.)

MATHEMATICS AND PHYSICS.

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DÜHRING, E. Geschichte der principien der mechanik. Leipzig, 1877. O.
FORSYTH, A. R. Treatise on differential equations. London, 1885. O.
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QUARTERLY Journal of pure and applied mathematics. 14 vols. London, 1857-77. O.
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BALFOUR, F. M. Works. Memorial Edition. 4 vols. London, 1885. Q.
BRUNTON, T. L. Text-book of pharmacology, therapeutics, and materia medica. Philadelphia, 1885. O.
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CURRENT INFORMATION.

THE NEW PHYSICAL LABORATORY.

The corner-stone of the new Physical Laboratory was laid on March 29, 1886, by Hon. George W. Dobbin, President of the Board of Trustees of the University. The following articles were deposited in the stone:—

The last Register and Annual Report of the University; the last number of the University Circulars; copies of the following journals published by the University: American Journal of Mathematics, the American Chemical Journal, the American Journal of Philology, Studies in Historical and Political Science, Studies from the Biological Laboratory; Excursion Map of Baltimore; the Sylvester Medal, in bronze; a copy, in wax, of the University seal; coins of the United States; various scientific pamphlets; copies of the Baltimore daily newspapers.

The architects, Messrs. Baldwin and Pennington, of Baltimore, have furnished the following statement as to the building:

* * * "The construction of the Physical Laboratory building for the Johns Hopkins University, at the north west corner of Monument and Garden streets, was commenced in September, 1885, according to drawings and specifications furnished by E. F. Baldwin and Josias Pennington, architects, and to be subject to their superintendence and approval. The building fronts 71′ 6″ on Monument Street, and 116 feet on Garden Street. It will be four stories in height, besides basement and attic, with an octagon tower at the south-east corner, surmounted by an observatory with a revolving dome 21 feet in diameter. The inside walls of the building will be finished in brick, and the floors will be three thicknesses, resting on heavy beams about six feet apart, and dressed on the underside, forming the ceiling below, no joists being used,—now termed slow-burning construction, and being the first of the kind used in this city.

"The contract for the building was signed September 21, 1885, by Mr. J. Hall Pleasants, chairman of the Building Committee, for the University, and by Messrs. Wm. Ferguson & Brother, contractors for the building, which is to be of brick, with Dauphin County brown sand-stone trimmings. The brick work is being done by Mr. Wesley Hall; the sand-stone by Messrs. Hamilton & Mann; the plumbing and gas-fitting by Mr. John F. McConnell; the heating and ventilation by Messrs. Bartlett, Hayward & Co., under the direction of Mr. C. W. Newton. The boilers for supplying the same will be located about 120 feet off and the warm air blown under Monument Street through brick ducts into the building and distributed to flues at points under the basement floor, this mode of heating being the first of the kind done in this city. In the centre of the building and under the basement floor are located sub-cellars or vaults, built with air spaces on the sides and brick arches above, where an even temperature can be obtained. The halls of the basement are arched in brick, with stone steps to the first floor, to which point the work has now reached."

Professor Rodolfo Lanciani, of Rome, will give a course of lectures on Roman Archaeology during the next academic year. He has been for some years professor of archaeology at the Roman university, and inspector of excavations for the city; and is also one of the leading members of the archaeological commission of Rome, and of the Pontifical Archaeological Society. Though still quite young, he is one of the first authorities on Roman archaeology, and has followed with greater care than any other archaeologist, the important excavations that have laid bare, from 1871 to 1886, so considerable a part of the ancient city. In 1880 he published "I comentarii di Frontino intorno le acque e gli aquedotti. Sylloge epigrafica aquaria," a learned work crowned by the Academy of the Lincei. This is but a small part of a great work to which he has been devoting years of research, a complete topography of the ancient city of Rome, critical and historical. Prof. Lanciani has contributed important papers to the *Bull. della Comm. Archeologica*, to the *Notizie degli Scavi*, and other archaeological periodicals, besides separate works, such as: "Iscrizioni dell'Anfiteatro Flavio" (1880).

DEATH OF PROFESSOR CHARLES D. MORRIS.

Resolutions of the University Philological Association, March 5, 1886.

Resolved, that while the various tributes of respect heretofore paid to the memory of Professor Morris have most fittingly held up to view his services to this University, to his colleagues at large, and to his students, we as an Association owe him a peculiar debt which it is our privilege to acknowledge.

Professor Charles D. Morris was intimately connected with the Philological Association of the Johns Hopkins University from its beginning. He was in entire sympathy with its aims, and for nearly ten years furthered them, by the prompt performance of every duty, by his readiness in contributing his own generous share to our proceedings, and by sustained interest in all good work. To this he added a rare discrimination, which bestowed where possible a full measure of praise; while he did not abate a jot of his own firm judgment. He scarcely ever missed a meeting of this Association, and his influence on the proceedings was marked, in many ways.

Even as a listener his presence was always felt. His brief and forcible remarks of discriminating criticism, of fruitful inquiry, or of approval, were always highly prized. He welcomed a good thing enthusiastically, from whatever quarter it came, in whatever subject it appeared. He was quick to discern interesting applications of theory or fact, and thus contributed towards making the speaker feel at his ease, outside of his own subject.

Especially to be commemorated is the kindly sympathy he extended to younger men, who appeared for the first time before the Association and his appreciation of what was new and good in their articles. More than one young scholar owes his first feeling of confidence in his own independent work to the appreciation and encouragement received from Professor Morris.

His own contributions were models of clear thought, and of skilful presentation, in choice English. However far his theme might be from the studies of his listener, the latter was under the spell of his personality from the first, and his personality was an inspiration.

He made his associates love scholarship more, while loving science none the less; and he himself made scholarship lovely, so that others felt more proud of belonging to the guild of scholars, because he adorned it.

Resolved, that this minute be entered on the records of this Association, and a copy of it be sent to Professor Morris's relatives.

Henry Wood,
Maurice Bloomfield,
Minton Warren,
Committee.

A course of lectures, on Selected Problems in Morphology, was given in the Biological Laboratory, as follows:

H. V. Wilson. On the Affinity and Phylogeny of the Cubo-medusae as illustrated by the Anatomy and Histology of Cheiropsalamus.

G. B. Haldeman. On the Inversion of the Germ Layers of Rodents.

A. T. Bruce. On the Embryology of Insects. (Two lectures).

E. A. Andrews. Asexual Multiplication of Annelids.

H. Orr. Asexual Multiplication of Tunicata.

W. K. Brooks. On Asexual Multiplication.

F. H. Herrick. On the Development of the Crustacea.

J. Nelson. Methods of Reproduction in relation to the problem of Sex. (Several lectures).

J. P. McMurrich. The Embryology of Gasteropods.

H. H. Donaldson (Ph. D., J. H. U., 1885) has been appointed Associate in Psychology, and Louis Duncan (Ph. D., J. H. U., 1885) has been appointed Associate in Electricity.

TENTH ANNIVERSARY.

The tenth anniversary of the University was celebrated on Monday, April 26. The applications for cards of admission to the public exercises greatly exceeded the capacity of any of the halls of the University, and the Trustees of the Mt. Vernon Place Methodist Episcopal Church kindly acceded to a request for the use of their edifice.

The trustees, faculty, graduates, and students, with invited guests, assembled at the University buildings and went in procession to the church, where the exercises were held at 12 m.

After prayer by the Rev. Dr. Longacre, addresses were made as follows:

On some of the Humane Aspects of Medical Science, by W. H. Welch, M. D., Professor of Pathology.

On the Purposes of a Physical Laboratory, by H. A. Rowland, Ph. D., Professor of Physics.

On the Present Aspects of Classical Study, by B. L. Gildersleeve, Ph. D., Professor of Greek.

An address, with reference to the work of the last ten years, was then made on behalf of the Trustees by James Carey Thomas, M. D.

An ode written for the occasion by Richard E. Burton, A. B., a graduate student of the University, was then read. The exercises closed with the bestowal of diplomas by the President.

The trustees, faculty, graduates, and a few invited guests met at luncheon in the gymnasium at 2.30 p. m. Addresses were made by the President of the University, Hon. George W. Dobbin, Hon. George William Brown, Rev. Dr. George E. Ellis, of Boston, Professor S. E. Baldwin, of Yale College, Professor Johnston, of Princeton, and others.

On motion of Professor T. Craig, seconded by Professor E. B. Wilson, of Bryn Mawr College, it was resolved to form an association of the graduates of the University, and by further resolution a committee of ten, consisting of Drs. T. Craig, E. M. Hartwell, F. G. Allinson, W. H. Howell, and H. A. Todd, Messrs. H. J. Bowdoin, Allan McLane, John Glenn, Jr., Edgar Goodman, and Edward Ingle, were designated to take the matter in hand.

A resolution was also adopted for the appointment of a committee of seven to secure a memorial of Professor C. D. Morris. Professors Gildersleeve and Warren, Drs. Allinson, Marquand, and Spieker, Messrs. John Glenn, Jr. and Allan McLane were designated as such committee.

In the afternoon, the buildings of the Johns Hopkins Hospital were thrown open to visitors.

In the evening, a reception was given in the University buildings by the President and Faculty to the graduates and students and their friends. It was estimated that a thousand persons were present.

Dr. E. M. Hartwell acted as chief marshal, with the following aids: Messrs. H. B. Adams, L. Bell, W. B. Canfield, J. Cummings, D. R. Dewey, W. C. Ferguson, J. A. Fisher, H. B. Gardner, R. C. Gildersleeve, J. S. Hodges, W. A. Jones, W. R. Molinard, A. T. Murray, G. H. F. Nuttall, B. T. Roberts, Jr., C. B. Stetson, M. P. Stevens, R. M. Tarleton, J. W. Williams, and L. Williams.

Messrs. H. M. Brune, A. R. L. Dohme, D. M. Reese, H. O. Thompson, A. C. Woods, and W. K. Williams acted as ushers at the public exercises.

The general Committee of Reception consisted of Messrs. M. Warren, H. B. Adams, M. Bloomfield, W. K. Brooks, T. Craig, A. M. Elliott, H. N. Morse, W. E. Story, G. H. Williams, and H. Wood, and special committees were present in the evening in Hopkins Hall, the libraries, and laboratories.

The committee on Decorations consisted of Messrs. E. M. Hartwell, A. L. Frothingham, Jr., and H. W. Smyth.

In the next number of the AMERICAN JOURNAL OF MATHEMATICS (Vol. VIII, No. 3) will be commenced the publication of a course of lectures on the Theory of Reciprocants, now being delivered at the University of Oxford, by Professor Sylvester. The lectures will present in a simple form the elements of Professor Sylvester's newest investigation.

UNIVERSITY EXAMINATIONS OF UNDERGRADUATE CLASSES, MAY 27--JUNE 8, 1886.

The MORNING SESSIONS will be from 9 a. m. to 12 m., and the AFTERNOON SESSIONS from 3 to 6 p. m.

Thursday, May 27.

MORNING.

General Physics. (*First Session*).
Physics: Major. (*First Session*).
Biology: Major. (*First Session*).

AFTERNOON.

Greek: Major. (*First Session*).
Phys. Geog., Hist. and English. (P.H.E.)
Mathematics: Major. (*First Session.*)

Friday, May 28.

MORNING.

General Physics. (*Second Session.*)
Physics: Major. (*Second Session.*)
Latin: Major. (*First Session.*)

AFTERNOON.

Greek: Minor. (*First Session.*)
Greek: Major. (*Second Session.*)
Polit. Econ.: Minor. (*First Session.*)

Monday, May 31.

MORNING.

Chemistry: Minor (including Mineralogy.) (*First Session.*)
Chemistry: Major. (*First Session.*)
Greek: Minor. (*Second Session.*)

AFTERNOON.

Mathematics: Minor. (*First Session.*)
Latin: Major. (*Second Session.*)

Tuesday, June 1.

MORNING.

Chemistry: Minor. (*Second Session.*)
Chemistry: Major. (*Second Session.*)

AFTERNOON.

Mathematics: Major. (*Second Session.*)
Mathematics: Minor. (*Second Session.*)
Biology: Minor. (*First Session.*)

Wednesday, June 2.

MORNING.

German: Minor. (*First Session.*)
German: Major. (*First Session.*)

AFTERNOON.

Latin: Minor. (*First Session.*)

Thursday, June 3.

MORNING.

German: Minor. (*Second Session.*)
German: Major. (*Second Session.*)

AFTERNOON.

Logic, Ethics and Psychol. (L. E. P.)
Latin: Minor. (*Second Session.*)

Friday, June 4.

MORNING.

French: Minor. (*First Session.*)
French: Major. (*First Session.*)
International Law.

AFTERNOON.

History: Major. (*First Session.*)
Biology: Major. (*Second Session.*)

Monday, June 7.

MORNING.

English: Minor. (*First Session.*)
English: Major. (*First Session.*)
Biology: Minor. (*Second Session.*)

AFTERNOON.

History: Major. (*Second Session.*)

Tuesday, June 8.

MORNING.

English: Major. (*Second Session.*)
English: Minor. (*Second Session.*)
Polit. Econ.: Minor. (*Second Session.*)

AFTERNOON.

French: Minor. (*Second Session.*)
French: Major. (*Second Session.*)
Constitutional History.

MATRICULATION EXAMINATIONS, JUNE AND OCTOBER, 1886.

Examinations for admission and matriculation will be held on the following dates:

Wednesday, June 9, and Friday, October 1.

9 a. m.—Preliminary examination.

10 a. m.—History (for matriculation and preliminary medical course).

11 a. m.—English (for matriculation and preliminary medical course).

12 m.—Science (for matriculation and preliminary medical course).

3 p. m.—German (for matriculation in place of Greek, for admission to the lowest classes, and to absolve the requirements of a minor course).

4.30 p. m.—French (for matriculation in place of Greek, for admission to the lowest classes, and to absolve the requirements of a minor course).

Thursday, June 10, and Saturday, October 2.

9 a. m.—Latin (for matriculation and preliminary medical course).

3 p. m.—Greek (for matriculation).

Friday, June 11, and Monday, October 4.

9 a. m.—Mathematics (for matriculation and preliminary medical course).

Degrees will be conferred Monday, June 14, at 6 p. m.

The next academic year begins Friday, October 1, 1886.

The Johns Hopkins University Circulars are printed by Messrs. JOHN MURPHY & CO., No. 182 West Baltimore Street, Baltimore, from whom single copies may be obtained. They may also be procured from Messrs. CUSHINGS & BAILEY, No. 262 West Baltimore Street, Baltimore. Subscription, $1.00 a year.

JOHNS HOPKINS UNIVERSITY CIRCULARS

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TENTH ANNIVERSARY OF THE JOHNS HOPKINS UNIVERSITY, APRIL 26, 1886.

ADDRESSES AND ODE.

[An account of the exercises at the Tenth Anniversary is given in Circular No. 49, May, 1886.]

ON SOME OF THE HUMANE ASPECTS OF MEDICAL SCIENCE.

By WILLIAM H. WELCH, M. D., Professor of Pathology.

Your attention will be called with just pride to-day to the achievements of this university during the first decade of its existence. Its contributions to letters and to science, its high standard of education and its usefulness in many directions are themes which are appropriate to the occasion. But in celebrating the past and the present we look forward with courage and enthusiasm to the future. For this future the subject which is now uppermost in the plans and the councils of the university is the establishment and the development of the medical department, in accordance with the conception of the munificent founder of the university and of the hospital. As the past ten years have witnessed the development of the philosophical department to its present position of high achievement and active usefulness, so it is hoped that the close of another decade will look back upon a similar record of good work and of progress in the medical department.

The higher purposes of medical education can be attained only by the establishment of well equipped laboratories and by the foundation of hospitals. For these, in a country where advanced education is dependent upon private benevolence, endowments are necessary. It is not a little remarkable that the first considerable bequest for the beneficent purposes of medical education in this country was made by the far-sighted founder of this university, whose example in this respect has already been an inspiration for others to follow.

It is a wise provision that the medical department has been placed in organic connection with the other departments of the university; that it is coördinate with these. The relation which universities and medical schools should bear to each other has given rise to no little discussion in several of the universities of Europe, and the conclusion has been reached that for many reasons the interests of each are best subserved by making the medical school a department of the university, rather than by the foundation of independent schools of medicine. Besides the fact that certain branches of study belong equally to the philosophical and to the medical faculty, or are upon the border line between these, experience has shown that this connection conduces to greater solidity, to a more elevated tone, and to a broader and more enlightened system of medical education.

At the outset of this undertaking in this university it may serve a useful purpose to call to mind that the objects which are to be kept in view in the foundation of the medical department are humane, that their ultimate design is the relief of human suffering and the advancement of human welfare.

It cannot be doubted that the training of intelligent, competent, and faithful physicians, whose life-work is devoted to the treatment of disease, is a benefaction to mankind. The means to be employed for this training have become much more elaborate than formerly was the case, and it is not impossible that the question might arise in the minds of some, whether, with all of these modern laboratories and appliances, and objects of study, the great aims of medical teaching, the knowledge and the treatment of disease, are not lost sight of. Such a doubt, if it exists, is without reasonable basis, as I shall attempt to show; the motive which suggests it, however, is to be respected, for it is true that the great objects of medical teaching are and always should remain the diagnosis, the prevention, and the treatment of disease.

The changes which have come about in the requirements of medical education are due, in great part, to the advancements in medical science. These advances have been all along the line. In anatomy and physiology, subjects which are the foundation of medical study, our knowledge of the structure and of the functions of the body in health has been widened, and in no small part as the result of work done in the biological laboratory of this university. Clinical medicine has profited by the introduction of more precise means for the discrimination of diseases, and by the addition of new remedies which are derived, in part, from the resources of synthetic chemistry. The finer changes of tissue and of function in disease have been the subject of much fruitful investigation during recent years. Of all modern discoveries in medical science, however, none have awakened greater interest or are of further reaching importance than those relating to the causation of disease. We have learned to recognize, in certain minute organisms, the specific causes of many of the most devastating diseases. These discoveries, which belong alike to the department of pathology, and to that of hygiene, have already had an important influence upon the management of disease, particularly in surgical practice. But it is in the prevention of diseases, especially of epidemic diseases, that this increasing knowledge of their causation is destined to do the most good. Although the prevention of disease is the highest aim of medical science, the cultivation of this branch of medicine is of comparatively recent date. The large medical schools of Europe have awakened only within the last few years to the importance of establishing hygienic laboratories, in which are investigated the causation of diseases, the laws governing the origin and the spread of epidemics, the principles of ventilation, of heating, of sewerage, the influence of the air, of the ground, of the water in the production of certain diseases, in a word, all that pertains to the preservation of the health of communities and the warding off of preventable diseases. Investigations in these directions have already accomplished much toward the preservation of public health. A notable instance of this is the great improvement in the healthfulness of the city of Munich, which has resulted from the introduction of important sanitary measures based upon investigations carried on in the magnificent Institute of Hygiene of the University. Munich, in which formerly typhoid fever was present almost constantly in an epidemic form, has been freed from this scourge. It would not be difficult to show that in many other ways the advancements in medical science have contributed to the relief of disease, and have promoted the health and consequently the happiness of mankind. Here, however, is not the time nor the occasion to enter into details concerning the progress of medicine, or to discuss the practical applications of recent medical discoveries. My purpose is to emphasize the fact that the researches which are carried on in all of the different departments of medicine tend toward one common object, and this is a better understanding of diseases, as regards their nature, their causation, their discrimination from each other, and above all, as regards their prevention and treatment.

In order to attain this object it is necessary that the labor of investigation should be divided. The time has gone by when one mind can compass all which has been ascertained in the medical sciences. The division of labor has led to most fruitful results, and at the same time a superficial observer might come to the conclusion that the work in certain departments has little or no relation to the great practical objects of medical study. This, however, would be an error. He who studies the ultimate structure of a nerve fibre, or the law of contraction of a muscle is contributing just as truly to the furtherance of our knowledge of the diseases of nerve and of muscle as is he whose studies are directed more immediately to these latter subjects. The former investigator often furnishes the only solid basis upon which the latter can build his superstructure.

By this division of labor it has come about that there are those who cultivate each special subdivision in the medical sciences as an end in itself. There will be found those who are ready to devote years of patient study and of research to some one subject, no matter how narrow the field for investigation may seem or how remote the bearing of the subject upon practical medicine may at first glance appear. It is only by this concentration of energy that the best results can be obtained and the true interests of medical science most effectually advanced. The good work done in one department does not stand alone; it aids progress in other departments, often in ways which cannot be foreseen. The physician who ministers to disease at the bedside, and the sanitarian who institutes measures for the preservation of public health turn to advantage results obtained in laboratories by work which, in some of its stages, may seem to have been without direct application to practical medicine. There is, therefore, a community of interests and of ulterior purpose among all the workers in the field of medicine, among those who, relieved from the duties of practice, give their time to investigations in the laboratory and those who are actively engaged in the relief of disease.

The attractions of the study and the pursuit of medicine have been greatly increased by the progress which has been made in the development of the different subdivisions of medical science. Many departments of medicine now possess the interest and the attractions of a natural science. Here will be found problems of absorbing interest, some of which call into requisition powers of acute observation, some demand for their solution ingenuity in the device of new methods and of apparatus, others require a profound knowledge of physics, or of chemistry, or of mathematics, and others call especially for well developed faculties of logical inference and of wide generalization. The rewards are great and of these the greatest is the consciousness that the work is for the advancement of the welfare of humanity in the preservation of health, the relief of suffering, and the promotion of happiness. What wonder, then, that a larger and larger number of those who have enjoyed the benefits of a liberal education are attracted to the study of medicine?

Experiment and observation of nature have taken the place, in the medical as well as in other sciences, of deductive reasoning and appeal to authority. In former times medical teaching consisted chiefly in didactic lectures which originally were for the most part commentaries on the great medical writers of antiquity. Useful as didactic lectures may have been in mediæval medical instruction, their value for the present time has been greatly lessened by the multiplication of good text-books in every department of medicine. With the decadence of the purely didactic lecture as the main feature in the system of medical education, the importance of laboratory instruction, of clinical teaching, and in general of demonstrative and objective methods of imparting knowledge has become better recognized.

There is no more striking illustration of the beneficent side of medicine than in the application of medical science to hospital work. In the construction of a properly planned hospital, application is

made of the results of investigation in hygiene. It is believed that an unsurpassed example of the application of the most approved principles of sanitary science to hospital construction will be found in the Johns Hopkins Hospital, which is destined to become an ornament and a splendid benefaction to this city. It is not necessary to dwell upon the benevolent uses of such a hospital, pertinent as the subject is to my theme. It needs no statement to prove the inestimable boon which those who seek relief in well-managed hospitals find in the best medical and surgical attendance, in the trained nursing, in the provision of suitable diet, and in cleanly and health-bringing surroundings. Not the least of the blessings which may be expected from the Johns Hopkins Hospital is the education of trained nurses, whose ministrations will greatly increase the efficiency of the hospital. The occupation of a trained nurse has become a noble profession for women. The benefits to be derived from their services can be fully appreciated only by those who have had practical experience in their employment.

It may not be inappropriate in this connection to allude to the relations between medical teaching and the interests of patients in hospitals. I believe that considerable misconception exists concerning this subject. While it is generally admitted that in any course of medical education opportunity should be given for the study of disease in hospitals, nevertheless some believe that this must be a misfortune for the patient. I can state as a matter of observation and experience that by every right-minded physician the interests of patients in hospitals are placed foremost. The late Dr. Austin Flint, one of the greatest clinical teachers which this country has produced, expressed sentiments, from which there can be no dissent, in his advice to medical students, when he said, "Manifestations of indifference or harshness toward patients in charitable institutions deserve to be stigmatized as brutal. These patients have claims of poverty added to those arising from their diseases. Brutality is less reprehensible when manifested toward those whose influence is valuable, from whom fees are expected, and who can terminate at any moment professional relations with their medical advisers." These precepts embody the practice of one who made the fullest use for all legitimate purposes of abundant opportunities of clinical study and observation in hospitals. They are the precepts which govern the action of the great body of physicians who give their time and skill to needy patients in hospitals. Did time permit it could be shown that the benign uses of hospitals for purposes of medical teaching are of reciprocal benefit, and that the interests of patients, instead of being sacrificed, are thereby promoted.

But I have already reached the limit of time allotted to these remarks. There are many other phases of medical science in which its humane aspects might be dwelt upon. My purpose has been to call to your attention only to those beneficent aims which suggest themselves most prominently in connection with the organization of a medical school and hospital. The various departments of medical science require no defence, for they are in themselves legitimate objects of pursuit; but they acquire a higher interest and appeal more strongly to the co-operation of the public when it is made apparent that their aims are to serve the higher interests of humanity. When a great medical foundation rests upon private benevolence, it is particularly appropriate that these humane and noble purposes should be emphasized.

THE PHYSICAL LABORATORY IN MODERN EDUCATION.

By Henry A. Rowland, Ph. D., Professor of Physics.

From the moment we are born into this world down to the day when we leave it, we are called upon every moment to exercise our judgment with respect to matters pertaining to our welfare. While nature has supplied us with instincts which take the place of reason in our infancy, and which form the basis of action in very many persons through life, yet, more and more as the world progresses and as we depart from the age of childhood, we are forced to discriminate between right and wrong, between truth and falsehood. No longer can we shelter ourselves behind those in authority over us, but we must come to the front and each one decide for himself what to believe and how to act in the daily routine and the emergencies of life. This is not given to us as a duty which we can neglect, if we please, but it is that which every man or woman, consciously or unconsciously, must go through with.

Most persons cut this gordian knot, which they cannot untangle, by accepting the opinions which have been taught them and which appear correct to their particular circle of friends and associates: others take the opposite extreme and, with intellectual arrogance, seek to build up their opinions and beliefs from the very foundation, individually and alone, without help from others. Intermediate between these two extremes comes the man with full respect for the opinions of those around him, and yet with such discrimination that he sees a chance of error in all and most of all in himself. He has a longing for the truth and is willing to test himself, to test others and to test nature until he finds it. He has the courage of his opinions when thus carefully formed and is then, but not till then, willing to stand before the world and proclaim what he considers the truth. Like Galileo and Copernicus he inaugurates a new era in science, or like Luther, in the religious belief of mankind. He neither shrinks within himself at the thought of having an opinion of his own, nor yet believes it to be the only one worth considering in the world; he is neither crushed with intellectual humility, nor yet exalted with intellectual pride; he sees that the problems of nature and society can be solved, and yet he knows that this can only come about by the combined intellect of the world acting through ages of time and that he, though his intellect were that of Newton, can, at best, do very little toward it. Knowing this he seeks all the aids in his power to ascertain the truth and if he, through either ambition or love of truth, wishes to impress his opinions on the world, he first takes care to have them correct. Above all he is willing to abstain from having opinions on subjects of which he knows nothing.

It is the province of modern education to form such a mind while at the same time giving to it enough knowledge to have a broad outlook over the world of science, art and letters. Time will not permit me to discuss the subject of education in general, and, indeed, I would be transgressing the principles above laid down if I should attempt it. I shall only call attention at this present time to the place of the laboratory in modern education. I have often had a great desire to know the state of mind of the more eminent of mankind before modern science changed the world to its present condition and exercised its influence on all departments of knowledge and speculation. But I have failed to picture to myself clearly such a mind while, at the same time,

the study of human nature, as it exists at present, shows me much that I suppose to be in common with it. As far as I can see, the unscientific mind differs from the scientific in this, that it is willing to accept and make statements of which it has no clear conception to begin with and of whose truth it is not assured. It is an irresponsible state of mind without clearness of conception, where the connection between the thought and its object is of the vaguest description. It is the state of mind where opinions are given and accepted without ever being subjected to rigid tests, and it may have some connection with that state of mind where everything has a personal aspect and we are guided by feelings rather than reason.

When, by education, we attempt to correct these faults it is necessary that we have some standard of absolute truth: that we bring the mind in direct contact with it and let it be convinced of its errors again and again. We may state, like the philosophers who lived before Galileo, that large bodies fall faster than small ones, but when we see them strike the ground together we know that our previous opinion was false and we learn that even the intellect of an Aristotle may be mistaken. Thus we are taught care in the formation of our opinions and find that the unguided human mind goes astray almost without fail. We must correct it constantly and convince it of error over and over again until it discovers the proper method of reasoning, which will surely accord with the truth in whatever conclusions it may reach. There is, however, danger in this process that the mind may become over cautious and thus present a weakness when brought in contact with an unscrupulous person who cares little for truth and a great deal for effect. But if we believe in the maxim that truth will prevail and consider it the duty of all educated men to aid its progress, the kind of mind which I describe is the proper one to foster by education. Let the student be brought face to face with nature: let him exercise his reason with respect to the simplest physical phenomenon and then, in the laboratory, put his opinions to the test; the result is invariably humility, for he finds that nature has laws which must be discovered by labor and toil and not by wild flights of the imagination and scintillations of so-called genius.

Those who have studied the present state of education in the schools and colleges tell us that most subjects, including the sciences, are taught as an exercise to the memory. I myself have witnessed the melancholy sight in a fashionable school for young ladies of those who were born to be intellectual beings reciting page after page from memory, without any effort being made to discover whether they understood the subject or not. There are even many schools, so-called, where the subject of physics or natural philosophy itself is taught, without even a class experiment to illustrate the subject and connect the words with ideas. Words, mere words are taught and a state of mind far different from that above described is produced. If one were required to find a system of education which would the most surely and certainly disgust the student with any subject, I can conceive of none which would do this more quickly than this method, where he is forced to learn what he does not understand. It is said of the great Faraday that he never could understand any scientific experiment thoroughly until he had not only seen it performed by others, but had performed it himself. Shall we then expect children and youth to do what Faraday could not do? A thousand times better never teach the subject at all.

Tastes differ, but we may safely say that every subject of study which is thoroughly understood is a pleasure to the student. The healthy mind as well as the healthy body craves exercise, and the school room or the lecture room should be a source of positive enjoyment to those who enter it. Above all, the study of nature, from the magnificent universe, across which light itself, at the rate of 186,000 miles per second, cannot go in less than hundreds of years, down to the atom of which millions are required to build up the smallest microscopic object, should be the most interesting subject brought to the notice of the student.

Some are born blind to the beauties of the world around them, some have their tastes better developed in other directions, and some have minds incapable of ever understanding the simplest natural phenomenon; but there is also a large class of students who have at least ordinary powers and ordinary tastes for scientific pursuits: to train the powers of observation and classification let them study natural history, not only from books, but from prepared specimens or directly from nature: to give care in experiment and convince them that nature forgives no error, let them enter the chemical laboratory: to train them in exact and logical powers of reasoning, let them study mathematics: but to combine all this training in one and exhibit to their minds the most perfect and systematic method of discovering the exact laws of nature, let them study physics and astronomy, where observation, common sense and mathematics go hand in hand. The object of education is not only to produce a man who *knows*, but one who *does;* who makes his mark in the struggle of life and succeeds well in whatever he undertakes: who can solve the problems of nature and of humanity as they arise and who, when he knows he is right, can boldly convince the world of the fact. Men of action are needed as well as men of thought.

There is no doubt in my mind that this is the point in which much of our modern education fails. Why is it? I answer that the memory alone is trained and the reason and judgment are used merely to refer matters to some authority who is considered final, and worse than all they are not trained to apply their knowledge constantly. To produce men of action they must be trained in action. If the languages be studied, they must be made to translate from one language to the other until they have perfect facility in the process. If mathematics be studied, they must work problems, more problems, and problems again, until they have the use of what they know. If they study the sciences, they must enter the laboratory and stand face to face with nature; they must learn to test their knowledge constantly and thus see for themselves the sad results of vague speculation; they must learn by direct experiment that there is such a thing in the world as truth and that their own mind is most liable to error. They must try experiment after experiment and work problem after problem until they become men of action and not of theory.

This, then, is the use of the laboratory in general education, to train the mind in right modes of thought by constantly bringing it in contact with absolute truth and to give it a pleasant and profitable method of exercise which will call all its powers of reason and imagination into play. Its use in the special training of scientists needs no remark, for it is well known that it is absolutely essential. The only question is whether the education of specialists in science is worth undertaking at all, and of these I have only to consider natural philosophers or physicists. I might point to the world around me, to the steam engine, to labor-saving

machinery, to the telegraph, to all those inventions which make the present age the "Age of Electricity" and let that be my answer. Nobody could gainsay that the answer would be complete for all are benefitted by these applications of science, and he would be considered absurd who did not recognize their value. These follow in the train of physics but they are not physics; the cultivation of physics brings them and always will bring them, for the selfishness of mankind can always be relied upon to turn all things to profit. But in the education pertaining to a university we look for other results. The special physicist trained there must be taught to cultivate his science for its own sake. He must go forth into the world with enthusiasm for it and try to draw others into an appreciation of it, doing his part to convince the world that the study of nature is one of the most noble of pursuits, that there are other things worthy of the attention of mankind besides the pursuit of wealth. He must push forward and do what he can, according to his ability, to further the progress of his science.

Thus does the university, from its physical laboratory, send forth into the world the trained physicist to advance his science and to carry to other colleges and technical schools his enthusiasm and knowledge. Thus the whole country is educated in the subject and others are taught to devote their lives to its pursuit, while some make the applications to the ordinary pursuits of life that are appreciated by all.

But for myself I value in a scientific mind most of all that love of truth, that care in its pursuit and that humility of mind which makes the possibility of error always present more than any other quality. This is the mind which has built up modern science to its present perfection, which has laid one stone upon the other with such care that it to-day offers to the world the most complete monument to human reason. This is the mind which is destined to govern the world in the future and to solve problems pertaining to politics and humanity as well as to inanimate nature.

It is the only mind which appreciates the imperfections of the human reason and is thus careful to guard against them. It is the only mind that values the truth as it should be valued and ignores all personal feeling in its pursuit. And this is the mind the physical laboratory is built to cultivate.

ON THE PRESENT ASPECT OF CLASSICAL STUDY.

By B. L. GILDERSLEEVE, Ph. D., Professor of Greek.

The chance that made me the first professor appointed to a chair in this university has made it my duty to represent the school of letters on this festal day, which has been chosen for the commemoration of the first completed decennium of our existence as an institution. The work of the university, so far as it can be expressed by lectures and by publications, by the number of teachers and of students, by the hours spent in laboratory and seminary, is all of record. Judged even by the census standard of facts and figures, it will be granted that what has been done here in the last ten years does not fall short of the standard which was set up in 1876. Less measurable, but not less certain are the indications of our influence on the whole circle of university work in America, and whatever we may have failed to do, we have assuredly not failed in rousing to greater vigilance and stimulating to a more intense energy in other parts of the wide field, and whether in the way of approval or in the way of protest, our example has made for life and growth and progress. This life and growth and progress have found a material expression in the erection and equipment of model laboratories for biology, chemistry, physics. Departments that are less tangible in their material and in their methods have little to show the visitor except a few books and a goodly number of men—ardent students, who are busy with old problems and new, enriching themselves with the spoils of the past, laying up store for those who are to come after them, in the present neither envious nor afraid. As to this whole department of letters, then, that department which has naturally fallen most under my own observation, I can truly say that the healthy increase in the schools of language and literature is something that has transcended my most sanguine expectation. In numbers we outrank many of the minor German universities, and in the more abstruse and recondite studies, such as Assyrian and Sanskrit, we hold our own with some of the leading schools of Europe. As for our American sisters, it is not so easy to separate graduate work from undergraduate work in other American universities as it is here, and hence the comparison of numbers might not be fair, and might be misinterpreted, and instead of emphasizing too much our large number of graduate students, it may be better to say in regard to all the schools of the country in which higher work is done, that we count their success as our success, for we are all helpers one of another. And here I would take occasion to echo the wish—which I have often heard expressed of late,—that the university departments in all American institutions of learning might be so organized that students could pass from one to the other in the prosecution of a line of study just as they do in Germany, much to the advantage of their breadth of vision, their freedom from local or personal influence. For my own part, I have always congratulated myself that I was brought under the influence of three distinct and markedly distinct philological schools, Berlin, Göttingen, and Bonn, and I have no doubt that when the time comes, there will be a university exchange that will help us even more than the measure of it that we have thus far enjoyed. We then of the department of letters have our success to speak of on this day when a little "self-esteem grounded on just and right" may be pardonable, if not, as Milton says, profitable. But it is a success that carries with it the gravest responsibilities. The ark we bear contains more sacred vessels than it held when we set out, and on an occasion like this it becomes us not only to exchange hearty congratulations that we have been helped thus far on our way, but to renew our hold with greater vigor, and to plant our feet more firmly, with a clearer view of the path to be trod and the burden to be borne.

To some, I do not know to how many, certainly to some of those whom I am addressing, the special line of work to which my own life has been devoted may seem to have had its day, and to plan for the future of Greek is to plan for an elaborate structure on the foundation of some Table Rock, destined at no distant time to fall and disappear on the restless current of modern life. A monument was erected some years since to the memory of the last old woman that spoke Cornish, and it would require no great stretch of imagination on the part of some of our friends to fancy that some youth may be present here to-day who shall live to see the cremation of the last successor of Sir John Cheke on this side of

the Atlantic, of the last old woman, trousered or untrousered, that shall have discharged the office of a Professor of Greek in an American university. People who have reached a certain age and have become somewhat reflective and prophetic generally console themselves with Hezekiah's words. But I cannot content myself with the thought that there will be peace and truth in my days. There has not been much of either of these commodities in my first half-century, and I do not expect the market to be glutted with them in my second. Surely there is no sign that there will be any peace about Greek or truth about Greek in any period that I can reasonably hope to reach. But the peace and the truth that may be denied me from without are vouchsafed me abundantly from within, and while many of my fellow-workers are in woe for the silver shrines of Diana, and mourn for the abandonment of Greek, and sorrow that the trade in text-books languishes, I am serenely standing where I stood many, many years ago, when I published my first article on the "Necessity of the Classics," a title not to be confounded with the "Necessities of the Classics" about which one hears far too much. I live in the abiding assurance that what is inwrought in the structure of our history and our literature must survive so long as the history of our race and the history of our language shall survive. To disentwine the warp of the classics from the woof of our life is simply impossible. One mediæval writer every one must know, and measured by modern standards Dante was not a classical scholar of the first rank; his perspective of antiquity was false, his estimate of the poets of the past was far from being just, and yet what is Dante if you loosen his hold on the classic time? I will not speak of Milton, steeped in classic lore; I will speak of Shakespeare. None but those who have read Shakespeare with the eye of the classical scholar know how much the understanding of Shakespeare is dependent on training in the classics, and more than once when I have hesitated as to whether it was pedantry or not to use a Greek word in my English discourse, I have turned to Shakespeare.

Is this the judgment of a man who can see only through his own narrow casement? Scarcely had I set down those words when the following passage fell under my eye. It is to be found in the recent introductory lecture of the professor of poetry in the University of Oxford. "The thorough study of English literature, as such—literature, I mean as an art, indeed the finest of the fine arts, is hopeless unless based on an equally thorough study of the literatures of Greece and Rome. When so based adequate study will not be found exacting either of time or of labor. To know Shakespeare and Milton is the pleasant and crowning consummation of knowing Homer and Aeschylus, Catullus and Virgil. And upon no other terms can we obtain it."*

To be sure we have promise of mountains and marvels if we break with the past. What satisfied us in our boyhood no longer suits the fastidious taste of the present, and the Phoebus Apollo of our youth, clad as to his dazzling shoulders with a classic cloud, is shown up as nothing better than a padded dandy. Our adored Thackeray is no longer faultlessly attired in a garb of perfect English, he is simply a stylistic old beau; the plots in which we once took delight are nothing but vulgar tricks, and the lifting of a tea-kettle lid and the setting down of the same are intrigue enough for the conduct of a two-year-long novel. All this new literature has nothing to do with the classics. Far from it. And yet I am not at all shaken by the self-satisfied edicts of those who rule so large a portion of the reading world, and I maintain with unwavering confidence that all healthy literature must be kept in communion, direct or indirect, with the highest exemplars of our Indo-European stock; and if anything could prove the necessity of a return to healthy human nature, with its compassed form, its fair red and white, it would be the utter wearisomeness of so much recent fine writing, in which there is no blood, no sap, nothing but division and subdivision of nerve tissue. "A pagan suckled in a creed outworn" is a joy and delight in comparison with the languid, invertebrate children of the great goddess Anaemia.

I have watched with much interest the development of the study of artistic composition in English during the last few years. Indeed, it would have been necessary to stop one's ears to keep out the shrilling cicada-sound of "art for art's sake," and all the theoretical buzz of aesthetic criticism. The interest has not been unmingled with amusement because the apostles of progress are preaching very old doctrine—a doctrine which I shall be glad to reinforce so far as I can, before I acquit myself of this function. Art for art's sake involves the very hardest, the very driest study, the very kind of study for which we philologians and grammarians are contemned. The accomplished master in the Art of Dipping, who delighted the world a few weeks since by his Letters to Dead Authors, made his swallow-wing strong on the Elysian fields of the classics, and those who should hold him up as an example of the kind of classical scholar we ought to have, little know to what severe studies is due that easy grace. It is so cheap to talk about gerund-grinding and root-grubbing, as if gerund-grinding did not lead to the music of the spheres and root-grubbing to the discovery of the magic moly that guards against the spells of Circe, of "euphrasy and rue," that purge "the visual nerve." He who neglects the elements lacks the first conditions of the artistic life. In the old times great artists did not disdain to prepare their own varnishes and the old paintings stand fresh to this day, while many of their modern rivals, scarce a generation old, are falling into decay beyond the hope of recognition. The fair dream was embodied in machine pigments and the machine pigments flake off and with them the fair dream vanishes. If grammatical research is pressed with regard to truth, to that which is, then the gerund-grinding as the color-grinding not only has its warrant in itself as a useful exercise but it is sure to be available for higher purposes, and if it is not given to everyone to make use of grammatical results for artistic ends, still no organic fact is without its value, none will fail of its appropriate place in the completed system of art as of science. To me, as an ardent lover of literature, as one who was led through literature to grammar and not through grammar to literature, the fairest results of a long life of study have been the visions of that cosmic beauty, which reveals itself when the infinitely little fills up the wavering outline and the features stand out pure and perfect against the sky of God's truth. Now for the study of literature as an art we have everything to learn from the old critics and what our own Sylvester, our own Lanier have re-discovered as to the science of verse is a chapter from antique rhetoric. Mr. Lowell has recently pointed out the great secret of Gray's abiding popularity. That consummate master did not disdain the close

*F. T. Palgrave, *Province and Study of Poetry.*

analysis of the sensuous effect of sound, and the melody of Coleridge is due in a measure to a conscious though fitful study in the same line. Of late an author, whose charm of style was first appreciated in this country, has written an essay in which he applies phonetic analysis to the works of our great prose writers, and strikes the dominant chord of what seems unconscious music. The essay might have been written in the beginning of the first century as well as the end of the nineteenth, and have been signed Dionysius of Halicarnassus as well as Robert Louis Stevenson.

Whether then it be for the historical unity of the race, whether it be for the human sanity of classical literature, whether it be for the influence on form either as example or precept, there is no danger that the ancient classics will be displaced from the list of studies necessary for the highest and truest culture. Nor do I think that the so-called hard and dry and minute research in this and cognate provinces of study will ever be abandoned in favor of a mere bellettristic phrasemongery about half-understood beauties. What is hard, what is dry, what is minute depends very much on the spirit in which it is approached. Some years since I attended a lecture by a great master. The theme was the vanishing of weak vowels in Latin. Candor compels me to state that although I pride myself on being interested in the most uninteresting things, I should have chosen another subject for a specimen-lecture. Candor compels me to state also that I very much question whether the illustrious teacher would accept all his own teachings to-day, such progress do grammarians make in devouring themselves as well as one another. I was much struck with the tone in which he announced his subject. It was the tone of a man who had seen the elements melt with fervent heat, and the weak vowels vanish at the sound of the last trump. The tone, indeed, seemed entirely too pathetic for the occasion, but as he went on and marshalled the facts, and set in order the long lines that connected the disappearance of the vowel with the downfall of a nationality, and great linguistic, great moral, great historical laws marched in stately procession before the vision of the student, the airy vowels that had flitted into the Nowhere seemed to be the lost soul of Roman life, and the Latin language, Roman literature, and Roman history were clothed with a new meaning. And so we of the language departments do not intend to be disturbed in our work by criticism on the arid details of our courses; nor on the other hand are we unmindful of the larger and more popular aspects of the wide field of culture which we occupy. There is no form of art, no phase of philosophy, of ethics, no development of physical science, that is alien to the student of language, and the student of physical science in his turn needs the human interest of our study to save his life from an austere and merciless quest of fact and principle in a domain where man enters only as a factor like any other factor. But first and last, the scientific standard must be upheld for the university man, be he a student of letters, be he a physicist; and that standard is the absolute truth, the ultimate truth. "Nothing imperfect is the measure of anything," says the prince of idealists.*

*ἀτελὲς γὰρ οὐδὲν οὐδενὸς μέτρον. Plato, Rpb. VI., 504 C.

A BRIEF REVIEW OF THE TEN YEARS' WORK OF THE UNIVERSITY.

By James Carey Thomas, M. D., one of the Trustees.

The foundation and growth of a University is an event of the greatest interest.

Its functions and use have been elaborately discussed by many modern thinkers and scholars. I shall call your attention to three statements of men of differing schools of thought.

Goldwin Smith, discussing Oxford University organization, says,

"Experience seems to show that the best way in which the University can promote learning and advance science is

"(1) by allowing its teachers, and especially the holders of its great Professorial chairs, a liberal margin for private study;

"(2) by keeping its libraries and scientific apparatus in full efficiency and opening them as liberally as possible;

"(3) by assisting through its press in the publication of learned works which an ordinary publisher would not undertake;

"(4) by making the best use of its power of conferring literary and scientific honors."

Matthew Arnold says, the university "ought to provide facilities, after the general education is finished, for the young man to go on in the line where his special aptitudes lead him, be it that of languages and literature, of mathematics, of the natural sciences, of the application of these sciences, or any other line, and follow the studies of this line systematically, under first-rate teaching."

Again, "The idea of a university is, as I have already said, that of an institution not only offering to young men facilities for graduating in that line of study to which their aptitudes direct them, but offering to them, also, facilities for following that line of study systematically under first-rate instruction. This second function is of incalculable importance, of far greater importance even than the first. It is impossible to over-value the importance to a young man of being brought in contact with a first-rate teacher of his matter of study, and of getting from him a clear notion of what the systematic study of it means."

John Henry Newman says, "It is a great point then to enlarge the range of studies which a university professes, even for the sake of the students; and though they cannot pursue every study which is open to them, they will be gainers by living among those and under those who represent the whole circle. This I conceive to be the advantage of a seat of universal learning, considered as a place of education. An assemblage of learned men, zealous for their own sciences and rivals of each other, are brought by familiar intercourse and for the sake of intellectual peace to adjust together the claims and relations of their respective subjects of investigation. They learn to respect, to consult, to aid each other. Thus is created a pure and clear atmosphere of thought, which the student also breathes, though in his own case he only pursues a few sciences out of the multitude. He apprehends the great outlines of knowledge, the principles on which it rests, the scale of its parts, its lights and its shades, its great and its little, as he otherwise cannot apprehend them.

"Hence it is that his education is called 'Liberal.' A habit of mind is formed which lasts through life, of which the attributes are freedom, equitableness, calmness, moderation and wisdom. This then I would assign as the special fruit of the education furnished at a university. . . . This is the main purpose of a university in the treatment of its students."

And a great thinker of another generation, George Fox, advised the setting up of schools for instructing "in whatsoever things were civil and useful in the creation."

We may then conclude that a university, wisely planned and faithfully administered, should be able to gather together a company of teachers, distinguished in character and learning; to present courses of study, important and thorough; and to attract scholars mature in age and competent by reason of previous training to pursue special lines of study, in order to fit themselves in a worthy manner for their chosen vocation. It should be wide in its scope and able to supplement the College, and aid students to perfect themselves in many departments of learning. It should provide liberally all the apparatus for this study. It should be rich in laboratories, in books, in instruments. It should endow research and stimulate investigation and discovery. It should be prepared to give results of work done within its halls speedy and wide publicity amongst scholars engaged in kindred pursuits. It should give its contribution to society by training men who are fitted to help in the solution of the problems of the age—scientific, social, political, moral and religious, both by stimulating the production of books, and by contributions to the journals and literature of the day. It should encourage all noble aspirations, conserve all good inheritances of the past, and create an atmosphere of enthusiasm for hard work. It should be able to bestow honors worthy of the name in reward for faithful devotion and for the successful fulfillment of its courses of study. Its work should be known and recognized where learning is known and recognized, and its name should carry weight in other universities and centres of research in the world of letters.

Such thoughts as these, I am sure, Judge Dobbin, were in your mind and in the minds of the other trustees to whom was entrusted by our late towns-man Johns Hopkins, the foundation and guidance of this university which was to bear his name. On the completion of the first decade of its existence, in the presence of the trustees and the President and faculty of the university, before the graduates, the present fellows, and students of the university, and in the presence of this company of our friends and fellow-citizens, it has seemed fitting to allude to these sentiments, as we proceed to consider the progress of this university.

I am glad to take this opportunity of replying in public to questions such as were asked me by a young Baltimorean, who the other day said: "Why do Baltimoreans have to go to New Haven or somewhere abroad to learn about the Johns Hopkins? "Why do you not tell us what is being done?" In order to do and crown[illegible] Baltimore audience, I have supposed my friend to lus, Catullus a[illegible] following questions, to which I shall briefly reply: obtain it."* [illegible] been attracted to the university?

To be sure we have promise of mountains and mar[illegible] break with the past. What satisfied us in our boyhood [illegible] suits the fastidious taste of the present, and the Phoebus[illegible]on? of our youth, clad as to his dazzling shoulders with a[illegible]us, etc., cloud, is shown up as nothing better than a padded dandy. adored Thackeray is no longer faultlessly attired in a gai[illegible] uni- perfect English, he is simply a stylistic old beau; the plots which we once took delight are nothing but vulgar tricks, an[illegible] the lifting of a tea-kettle lid and the setting down of the same are intrigue enough for the conduct of a two-year-long novel. All this new literature has nothing to do with the classics. Far from

The Board of Trustees was incorporated in August, 1869, at the instance of Johns Hopkins and during his lifetime. About a year after the death of the founder in December, 1873, the Board was put in possession of the endowment provided by his beneficence, and organized for work. The President of the Board, the late Galloway Cheston, took an active part in the enterprise, and by his advice greatly aided in laying the foundation of the University, and his name will always be honorably associated with its history. The other members of the Board, all of whom had been named by Johns Hopkins, were Reverdy Johnson, Jr., the first chairman of the Executive Committee, Francis T. King, Lewis N. Hopkins, Thomas M. Smith, William Hopkins, John W. Garrett, Francis White, Charles J. M. Gwinn, George W. Dobbin, George Wm. Brown, and James Carey Thomas.

What great teachers have been attracted?

It was soon apparent that the wise and untrammelled directions of Johns Hopkins to his trustees to found a university would attract the attention of those interested in the cause of education, especially in the United States.

The opportunity of developing an institution suited to the needs of the country was sufficient to draw to Baltimore from across the continent the then President of the University of California, Daniel C. Gilman, who was named to the trustees as the man best fitted by previous training and devotion to the study of educational methods, to advise and direct the establishment of the new foundation, by his former colleagues of Yale College—by President Eliot, of Harvard University, at once the most renowned and the most venerable institution of learning in the country—by President White, of Cornell University, then in the early days of its growing importance and usefulness—by President Angell, of the University of Michigan, the crowning institution of learning of the well-organized system of public instruction in that great and strong western State—and by numerous other leading educators. At the request of the trustees Mr. Gilman came to Baltimore, and after consultation with them accepted the Presidency of the Johns Hopkins University. Under his thoughtful care and constant and laborious effort the plan originally contemplated has been gradually and harmoniously developed.

Besides President Gilman the University also drew from across the ocean, from Woolwich, England, Professor Sylvester, one of the two greatest English mathematicians, and indeed one of the greatest of the world; and from Virginia, in our own land, Professor Gildersleeve, second to none in his attainments in and devotion to Greek and other classical study—besides younger men whose subsequent career has justified the bright promise of their early years. I shall not mention further by name the present distinguished staff of Professors and teachers, whose work I have alluded to and who form the permanent renown and attraction of the University.

I will give a list in chronological order of those gentlemen, not now connected with the University, who, for a longer or shorter period, have lectured here during the past ten years:

In Language and Literature, Professors F. J. Child, James Russell Lowell, W. D. Whitney, C. R. Lanman, Thomas C. Murray, H. C. G. Brandt, Sidney Lanier, too early lost, Professors W. W. Goodwin, J. A. Harrison, J. Rendel Harris, Hiram Corson, A. S. Cook, Messrs. George W. Cable, Edmund Gosse, Justin Winsor,

A. Melville Bell, Drs. Isaac H. Hall and W. Hayes Ward; in History and Political Science, Professors T. M. Cooley, F. A. Walker, W. F. Allen, the lamented J. L. Diman, H. Von Holst, Austin Scott, James Bryce, E. A. Freeman, who gave six lectures and imparted a decided impulse to historical study here, R. M. Venable, Messrs. J. J. Knox and Eugene Schuyler; in Archæology and Art, Messrs. W. W. Story, F. Seymour Haden, J. Thacher Clarke, W. J. Stillman, Dr. Charles Waldstein, and Mr. Frederick Wedmore; in Philosophy and Logic, Professors William James, G. S. Morris, Mr. C. S. Pierce, and Dr. Josiah Royce; in Physical and Mathematical Science, Professors J. E. Hilgard, J. Willard Gibbs, John Trowbridge, A. Graham Bell, S. P. Langley, Arthur Cayley, C. S. Hastings, and Sir William Thomson; in Chemistry and Biology, Professors J. W. Mallet, W. G. Farlow, J. McCrady, W. T. Sedgwick, H. Sewall, and W. Trelease.

At our Commencements, Anniversaries, and other gatherings, we have heard from Presidents Eliot and White, from Dean Stanley, Dean Howson, Professor Huxley, Archdeacon Farrar, Chief Justice Waite, Hon. W. M. Evarts, Dr. W. A. P. Martin, Dr. W. B. Carpenter, Hon. S. T. Wallis, J. B. Braithwaite and others.

Many of these have been listened to by those not members of the university who were specially interested in their subjects, and it may be fairly said that many eminent and great teachers have been both for long and short periods attracted to the university.

What university courses are here offered, and what graduate students have been attracted?

The courses of university studies that have been pursued have been so often and so fully referred to in the Reports and Circulars of the University, that I can only enumerate those: in higher Mathematics, in Physics, in Chemistry, in Mineralogy and Petrography, in Biology; in Greek, in Latin, in Sanskrit, in Hebrew, in Aramæan, in Arabic, in Assyrian, and in Sumero-Akkadian; in English, in German, in the Romance group of languages, including French, old and modern, Wallachian, Italian, Spanish, Catalan, old Provençal, modern Provençal, and Portuguese; in History, ancient and modern, in Political Economy, Physical and Historical Geography; in Psychology, Pedagogics and Philosophy, in Mental Hygiene and Ethics. In these studies advanced instruction has been given by all available means such as lectures, laboratory practice, seminary work, books, models and plates, in order to fit those who are preparing for teaching or special research.

That these courses have succeeded in attracting students of mature age is evident from the fact that out of the total number of students (923) enrolled during the decade, 590 have pursued graduate courses, and these 590 came from more than 100 different universities and colleges as widely separated as Russia and Japan.

What apparatus and appliances have been gathered together?

To aid in the instruction given, the trustees have from the first had in view securing the most convenient and free access to the most modern means of promoting research. They were greatly aided by the existence in Baltimore of a library of unusual value to students—the gift of the late George Peabody, and brought together with much care and diligence by the trustees, the provost, and the librarian of the Peabody Institute—and which has been liberally opened to members of the university. As a supplement to the Peabody collections the university has placed within its own walls twenty-nine thousand volumes—a portion of which are standard reference books needed by all the teachers and students, the remainder are special and often costly books which have been called for by the specialists here engaged in work.

The plans of the university being at first, from the nature of the case, tentative, the work was begun in two dwelling houses purchased in 1875, on Howard street near Monument street, and in a hall erected at the time and named after the founder, which contained an assembly room and accommodations for the library and for the biological laboratory, and in a chemical laboratory built at the same time, and this was for some time the modest seat of the university. The location was found more convenient than had been foreseen, both for students who lived in the city and for those that came from elsewhere, who readily found accommodation in lodgings suited to their taste and means. Easy access was had to the Peabody and other collections of books, as those of the Historical Society, and later of the Pratt Library, and there have gradually grown around the present site complete and well equipped laboratories. The chemical laboratory has been greatly enlarged and perfected. The biological laboratory adjoining has been erected after plans suggested by years of work and by comparison with foreign institutions of a similar kind, and there is now building near by the physical laboratory, of which Professor Rowland has been speaking to you to-day. Laboratory work in pathology has been begun in one of the buildings of the Johns Hopkins Hospital, and it is intended to erect the Medical School on a lot now owned by the university, adjacent to the hospital.

Into these various buildings have been gathered, at the suggestion and under the careful personal supervision of various experts, about $70,000 worth of apparatus of the most approved modern make, thus placing within the reach of investigators the means of pursuing advanced research as well as enabling students to become familiar by personal use with the newest methods of study and experiment.

What research is carried on—and what has been published?

The researches which have been made have been many and varied. I cannot refer to the more technical, such as those in mathematics and inorganic chemistry, &c., but briefly to the more easily stated.

Our knowledge of the nature of the sun, as perceived through the solar spectrum, has received accessions from the beautiful image, thrown from the gratings first made here by the agency of a wonderful dividing engine, the invention of the Professor of Physics. From this image a map of the spectrum has been published, very much more minute than any before made.

Researches in electricity and magnetism have been made under the auspices of the United States Government, with the coöperation of other nations; the mechanical equivalent of heat has been re-determined; investigations have been conducted in physiology, especially of the heart's action; lower animal life has been studied, especially that of the oyster in connection with the State of Maryland; both here and in Boston the cause of water pollution in great reservoirs has been discovered; the curious geological formation of our own neighborhood has been brought to notice and has attracted wide attention. The philologians and grammarians have been engaged in the investigation of Greek and Latin

syntax; in editing ancient writings, such as Pindar, the newly discovered Greek MSS. of the Teaching of the Twelve Apostles, and part of an old Syriac MS. of the New Testament. Baltimore is now one of the centres for the interpretation of Sanskrit texts and of Assyrian inscriptions. A great contribution has been made to the study of American Institutions, and new methods of historical research and of publication have been initiated.

It is with satisfaction that I state that these researches have been widely recognized at home and abroad, not as *promises* for the future, but as successful experiments recorded, and conclusions reached which have passed into the history of science. By means of them the fame of the university has been carried into every seat of learning in the world, from Oxford and Cambridge in England, to Tokio, Japan; from the northern and more modern universities of Sweden and Russia to the ancient seats of learning in Italy and Southern Europe. The exchanges on the shelves of our library, received with almost every foreign mail in return for the six scientific journals published by the university,* attest both its importance and its estimation outside its own walls. Besides this, personal and unsolicited testimonials from eminent men are on file in the office which have been received from many quarters.

These researches, delicate, prolonged, and important, and others not now mentioned, have been made by Professors, Fellows, and advanced students. Indeed the whole plan of fellowships has in reality been a most practical and efficient endowment of research and has richly repaid the university and the community in the importance and value of the results obtained.

Twenty young men who have not quite completed their work, as students following masters, but who have gone far enough to indicate that they are possessed of unusual ability, are annually chosen by the Academic Council and are encouraged by a generous stipend to devote all their time to study which is not of a distinctively professional character. They are chosen because of the hope they give of future achievements, or are selected on the evidence they submit of their previous intellectual attainments. The system here adopted has elsewhere been followed.

What has been the value of this training?

Has the training here been of value to the men that have submitted to the severe ordeal of discipline and who have often surrendered honorable and lucrative positions to avail themselves of the advantages offered for research and study? Or in other words are the diplomas to be given to-day as testimonials of the University to the attainments of those to whom they are so worthily awarded, of real value to their possessors?

Of the 69 persons who in these ten years have been admitted to the degree of Doctor of Philosophy, denoting proficiency in various lines of special graduate study, either in letters or in science, 56 have obtained honorable positions as professors and teachers in 32 universities and colleges; and of the 90 to whom the degree of Bachelor of Arts has been given, 20 have engaged in teaching in 16 colleges and high schools.

I will conclude this part of my subject by quoting the reply made by a graduate student from North Carolina, when asked what he had found here of most use, he replied: "The freedom of access to able teachers and the stimulant of studying in company with men of maturer minds than one meets elsewhere."

But what has the university done for this community?

Besides the incidental advantages which must accrue to any community from the presence of a great seat of learning, the trustees have had in mind from the first the special needs of this city and state. At the conclusion of the late war fewer boys were at college than at former periods. Many young men here and further south had foregone college training, and circumstances forbade the sending of others who were growing up. It was manifest that the need of our own people was first a college in order to train for life, or for further university instruction. So side by side with the university has developed the college department of the Johns Hopkins University. This was begun when the discussion of a fixed, a free or wholly or partly elective college course had not been so warmly debated as at the present time, but it was evident that the wide range which the development of various branches of knowledge has taken since the old arrangement of college studies was effected, and the limited time which can ordinarily be devoted by students to preparation for their life work, made a readjustment of the college course desirable. This was accomplished here by arranging, after a fixed matriculation, the studies in groups rather than years, and demanding in each group a certain required amount of training in other than the main study of the course. Thus classical students are required to study some science, scientific students some classics, and all to receive a fixed amount of general English training in literature, ethics, philosophy, and modern languages.

The seven groups, for which, in accordance with these principles, arrangements are now made, are these:—

1. Classical,—corresponding closely with what has been hitherto known in this country as the usual college course;

2. Mathematical–Physical,—which meets the wants of those who are expecting to enter upon the modern vocations in which rigid mathematical discipline is indispensable;

3. Chemical–Biological,—which is adapted to those, among others, who expect to enter upon the subsequent study of medicine;

4. Physical–Chemical,—which is most likely to be followed by students preparing for those scientific pursuits which are neither chiefly mathematical nor chiefly biological;

5. Latin–Mathematical,—which affords a good fundamental training, without prolonged attention to the study of Greek;

6. Historical–Political,—which furnishes a basis for the subsequent study of law;

7. Modern Language,—where French, German, English, and in exceptional cases, other modern languages, take the place of Latin and Greek in the traditional classical course.

It cannot be said that this arrangement is perfect, but it has worked well and great effort is made to have it at once liberal and adapted to the exigencies of active life. I should like all the time at my disposal to expand more fully this slight sketch of the college course which lies near my own heart, but must content

*1. The American Journal of Mathematics, commenced in 1878, now in its eighth volume; 2. The American Chemical Journal, commenced in 1879, now in its eighth volume; 3. The American Journal of Philology, commenced in 1880, now in its seventh volume; 4. Studies from the Biological Laboratory, commenced in 1879, now in its third volume; 5. Studies in Historical and Political Science, begun in 1882, of which the fourth series is in progress; 6. The Johns Hopkins University Circulars, begun in 1879, of which forty-nine numbers have been issued.

myself with stating that it has from the first attracted our own boys to whom great inducement has been held out, and who have proved some of our most enthusiastic and successful students, have won for themselves many of our own fellowships, and have gone out to positions of importance and emolument. Their number is rapidly increasing and the university is constantly endeavoring to make closer the connection between the high schools, whether private or public, and the collegiate department of the Johns Hopkins University.

Various free scholarships are annually offered to students coming from Maryland, Virginia, and North Carolina, and have been held by 150 students from these States. The existence in our midst of such advantages is stimulating our young men to avail themselves of them, and is increasing the number and efficiency of preliminary schools. We have now in the collegiate department one hundred and thirty students.

I have thus, in the briefest and most prosaic manner endeavored to summarize the work of ten years into the space of twice as many minutes. It has been impossible; although I have not even glanced at the various literary and scientific societies formed for themselves by the members of the university, nor alluded to the common college life, nor spoken of the work of the Christian Association of the University which has served an excellent purpose, but yet I think that I have shown that something has been done to bring together great teachers, to start liberal courses of study, to attract students, to collect libraries and apparatus, to stimulate research, to publish results, and have stated in what manner this work has been recognized, and how the needs of this community have been considered.

But I am sure that in reaching these conclusions you must feel how little has been done in comparison with what is practicable with longer time and greater resources. The perpetuation and enlargement of the university on a broad and liberal foundation should be the pride of every citizen. It is a great trust to be handed down to those who shall succeed us. Let us be careful to see that no detriment happen to it.

Amidst the jarring of contending factions and classes there needs must be thoughtful men, trained to habits of patient investigation and quiet study—amidst the rush of business and competition, men who in secluded laboratories pass hours and days in subtile experiments—amidst the selfishness of politicians and placemen, historians and philosophers and teachers who can recall the lessons of past ages and vindicate the great moral principles which underlie all true progress.

For these and other great purposes universities should exist and be richly endowed. They should be few, but strong.

A president of a growing western college, last week in Baltimore, emphasized most strongly the importance of adding efficiency to existing universities in order to make them great centres for training and research. The possessors of great wealth, most frequently in this country accumulated in the course of a single life, have often felt their responsibility in its ultimate destination. They have in many instances, amongst which the course of Johns Hopkins is conspicuous, returned their accumulated gains to the community in noble gifts, founding great institutions of learning and great charities, for the training of the future citizen and for the alleviation of human suffering. These should be fostered and enlarged, as has been done at Harvard and at Cornell, in order that the greatest good may be accomplished.

The training of *men* is after all the most important end of all educational effort. It is to you, young men, the sons of this new foundation, that your teachers and friends look as the best evidence of the success of their endeavor. Your learning, your usefulness, your accomplishments, your high aims and noble character, your achievements, whether in the pulpit or the forum, the college or the laboratory, at home and abroad will afford a continual and living reminder of this, the place of your training.

To a State founded on the beneficent precepts of Christianity, the walls of its defense must be not the physical strength of its citizens but their moral character. In vain will science harness the powers of the universe unless they are yoked to the chariot of peace and good will. In vain will learning and training give efficiency to individual influence and native genius, unless the purposes of the man are noble and far-reaching. The truth which sets free, is the truth which warms the heart and expands the sympathies, as well as enlightens the intellect, which is of Him who is the truth Himself. Let us have confidence in the supremacy of truth. Such has hitherto been the guiding lamp of the Johns Hopkins University. May it ever be the beacon of the future.

AN ODE TO THE JOHNS HOPKINS UNIVERSITY.

By Richard E. Burton, A. B.
(A graduate student of the University.)

I.

Fair hopes and many beat beneath the breast
So young, so blest,
Of our America, this sweet young Warrior-Knight
With front set starward underneath his crest,
With breast-plate blazoned with a legend bright
That reads: Truth, Liberty and Right.
Fair valiance erst was his in jousts of old,
And now, with lance at rest, but blithe and bold
He rides him straight to gain the guerdon great
That Peace his lady-love, or soon or late,
Will guerdon him withal
As glad years fall.
Unhelmeted he rides, and wide his gaze
Sweeps all the lists, and all the peopled ways.

II.

Our land is guarded in her plenteous peace
By firm-set fortresses, that quick increase
To ward away the wars that Error breeds,
The mighty train of man's misdeeds
That fall alone before the touch of Truth,
Whereto Sweet Science leans and leads, in sooth.
Science sits on these battlements
And cries abroad her gracious good intents;
Until her foes without
Grow faint and fling no battle-shout
Against her ramparts; and as time
Sweeps on, the peace-bells ring a broader chime,
And lo! each battle-plain
Is cleansed of carnage and the sight of slain,

For dim-eyed Sin and sister Sloth are ta'en.
From sea to sea the victory is won,
And Love is Lord from Sun to Sun.

III.

Our hearts would hail a bulwark bold
Late-builded, stout to stem all wrong of old;
Two lustrums gone beheld its birth,
To-day how wide of girth!
Its turrets stars of heaven greet,
Its walls hem in all Hopes and Healments meet,
At base fair earth-flowers swing their chalice-censers sweet.
Here flock the souls that hate such filmy ken
As fails to sight the plight of brother men;
Who long to rid them of mere greed for gain,
To sink the pride of place, that world-wide bane,
In deep desire to flash the crystal-clear
Broad light of God on races far and near;
A light no creed may clasp, no ritual phrase,
That shineth steadfast down the eternal days;
Whose fundament is Truth, Beauty its shrine,
Its capital robed Love, half-human, all divine.

IV.

From palm-fringed shores beset of southern seas,
From sundown lands of tilth and mighty trees,
From northern meadow-slopes of bloom and breeze,
From olden countries set across the main
We come, a train
Of morning pilgrims manifold of kin
But one in wish for service, set to win
From out the close-locked casket of the age,
Sans stain, sans petty rage,
The touchstone that may test the Heart of things
And prove it golden, graced with golden wings.

With purpose such, what tongue can set a bound
To dreams that may be ours, what song may sound
With music meet for signalling the fame
Enfolding fast these walls we love to name.

V.

Then hail foundation young! and two-fold tender hail
To them that manned the helm in early gale,
The ship a thing of straining sail!
Theirs be the glad fruition of this day
That looks upon a summer sea
Calm-stretching utterly;
With storm-stress dying to the east away,
And westward, whither beck the blessed Isles,
Smooth course and splendor of the sunset-smiles.
All hail each mariner! though humbler be his place,
Who fain would trim the ship and see her sail apace.
Ye farers all on life's unfathomed sea,
Keep watch to westward where your harbors be,
And gather treasures for your argosy.

VI.

What though we chant her praises under guise
Of fortress sturdy, or of sea-emprise
Ventured by white-winged ship, our hearts are all for thee,
Thou University,
Set midst this stately town of storied deeds
And twin with her in sowing vital seeds
For nourishment of needs:
Until ye twain shall cry,
As swift the years soft-sandaled fare and fly,
To myriad men: "Here living waters flow,
Here all bright blooms of Thought shall bud and blow."

The JOHNS HOPKINS UNIVERSITY CIRCULARS are published at convenient intervals during the academic year for the purpose of communicating intelligence to the various members of the university in respect to work which is here in progress, as well as for the purpose of promulgating official announcements from the governing and teaching bodies. During the current academic year, ten circulars will be issued in successive months, to be followed at the close of the year by an index.

Although these circulars are designed for the members of the university, they have frequently been called for by institutions and libraries at a distance, and also by individuals who are interested in the literary and scientific activity of this university. Subscriptions and exchanges are therefore received.

TERMS OF SUBSCRIPTION.

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Subscribers to the Circulars will also receive the Annual Register and Report of the University.

All subscriptions should be addressed to the "Publication Agency of the Johns Hopkins University."

Communications for the Circulars should be sent in prior to the first day of the month in which they are expected to appear.

UNIVERSITY CALENDAR.

Examinations for Admission begin Wednesday, June 9, at 9 a. m.
Degrees will be conferred Monday, June 14, at 6 p. m.
The present academic year closes Tuesday, June 15.
The eleventh academic year begins Friday, October 1.
The autumn Examinations for Admisssion will begin October 1, at 9 a. m.

University Circular 51, containing the announcements of the courses of instruction offered for the next academic year, will be ready at the close of June and will be sent on application.

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PROGRAMMES FOR 1886-87.

The following courses in literature and science are offered for the academic year which begins October 1, 1886. They are open to properly qualified young men according to conditions varying somewhat in each department. Detailed statements as to the different subjects are given in the programmes of the departments of instruction on subsequent pages. The Annual Register giving full statements as to the regulations and work of the University will be sent on application.

B. L. GILDERSLEEVE, *Professor of Greek.*

(*a*) will direct the Greek Seminary. *Twice weekly.*

(*b*) will conduct a course of Practical Exercises in Greek. *Twice weekly, from October to January.*

(*c*) will give a general Introduction to Hermeneutics and Criticism. *Weekly, after January* 1.

(*d*) will give a series of Readings in Aischylos, Sophokles, and Euripides. *Twice weekly, after January* 1.

(*e*) will hold a series of Conferences on Greek Syntax. *Weekly, last three months.*

G. STANLEY HALL, *Professor of Psychology and Pedagogics.*

(*a*) General Systematic Psychology. *Semi-weekly lectures and weekly conferences.*

(*b*) Pedagogics. *Weekly lecture and conference.*

(*c*) History of Philosophy.

PAUL HAUPT, *Professor of Shemitic Languages.*

(*a*) Hebrew. *Twice weekly.*

(*b*) Biblical Aramaean Grammar; Elements of Assyrian Grammar; Assyriological Exercises. *Each weekly.*

(*c*) Assyrian Language and Literature. *Twenty-four lectures.*

(*d*) Assyriological Winter School. *Daily, during January.*

H. N. MARTIN, *Professor of Biology.*

(*a*) will direct the Laboratory Work in Biology. *Daily.*

(*b*) will lecture on General Biology (*till April*) and the Embryology of the Chick and Mammal (*from April till close of session*). *Three times weekly.*

(*c*) will lecture on selected topics in Physiology. *Weekly.*

SIMON NEWCOMB, *Professor of Mathematics and Astronomy.*

(*a*) Mathematical Seminary. *Weekly.*

(*b*) Practical and Theoretical Astronomy. *Twice weekly.*

IRA REMSEN, *Professor of Chemistry.*

(*a*) will direct the Laboratory Work in Chemistry. *Daily.*

(*b*) Advanced Organic Chemistry; Theories of Chemistry. *Twice weekly.*

(*c*) General Chemistry. *Daily.*

(*d*) Compounds of Carbon. *Three times weekly.*

H. A. ROWLAND, *Professor of Physics.*

(*a*) will direct a course of advanced work in the Physical Laboratory. *Daily.*

(*b*) Electricity and Magnetism. *Four times weekly.*

WILLIAM H. WELCH, *Professor of Pathology.*

(*a*) will direct the work of the Pathological Laboratory.

(*b*) will lecture on Pathological Histology, Bacteriology, and General Pathology.

JOHN H. WRIGHT, *Professor of Classical Philology.*

(*a*) Aeschylus, Sophocles, and Survey of the Greek Drama (*first half-year*), Demosthenes and Survey of Greek Oratory (*second half-year*). *Four times weekly.*

(*b*) Greek Prose Composition; Classical Archæology and Antiquities. *Each weekly.*

(*c*) other courses to be hereafter announced.

H. B. ADAMS, *Associate Professor of History.*

(*a*) Seminary of History and Economics. *Weekly.*

(*b*) History of Politics. *Twice weekly.*

(*c*) Elements of International Law. *Twice weekly.*

(*d*) will direct the Undergraduate Courses in History, with assistance.

M. BLOOMFIELD, *Associate Professor of Sanskrit.*

(*a*) Sanskrit, Elementary and Advanced. *Each twice weekly.*

(*b*) Vedic Sanskrit (*first half-year*); Seminary; General Principles of Comparative Philology; Comparative Greek Grammar. *Each weekly.*

W. K. BROOKS, *Associate Professor of Morphology.*

(*a*) will direct the work of the Marine Laboratory.

(*b*) will lecture on the Elements of Zoölogy. *Twice weekly, from the Christmas recess until the end of the session.*

(*c*) will conduct a course in Animal Morphology.

T. CRAIG, *Associate Professor of Applied Mathematics.*
(*a*) Seminary. *Weekly.*
(*b*) Hydrodynamics; Theory of Functions (*first half-year*), Elasticity and Abelian Functions (*second half-year*). *Each three times weekly.*
(*c*) Linear Differential Equations, and Differential Invariants. *Twice weekly.*
(*d*) Differential Equations. *Twice weekly.*

A. M. ELLIOTT, *Associate Professor of Romance Languages.*
will give advanced courses in the Romance Languages, including Modern French Phonetics, Old French Philology, Comparative Romance Phonology, Italian Dialects, Seminary Work, etc.

GEORGE H. EMMOTT, *Associate Professor of Logic and Ethics, and Lecturer on Roman Law.*
(*a*) Deductive and Inductive Logic, and Ethics.
(*b*) Roman Law.

H. N. MORSE, *Associate Professor of Chemistry.*
(*a*) will assist in directing the Laboratory Work.
(*b*) will lecture on Stoichiometry and Inorganic Chemistry. *Each twice weekly.*

W. E. STORY, *Associate Professor of Mathematics.*
(*a*) Mathematical Seminary. *Weekly.*
(*b*) Introductory course for Graduates. *Daily.*
(*c*) Advanced course in Analytical Geometry. *Twice weekly.*
(*d*) Quaternions. *Three times weekly.*
(*e*) Analytical Geometry and Conic Sections. *Twice weekly.*

M. WARREN, *Associate Professor of Latin.*
(*a*) will conduct the Latin Seminary (Vergil). *Twice weekly.*
(*b*) Vergil and Roman Epic Poetry. *First half-year.*
(*c*) Macrobius (*first half-year*), Latin Palaeography (*second half-year*).
(*d*) Conferences on Latin Syntax. *Weekly, second half-year.*
(*e*) Cicero and Survey of Roman Oratory (*first half-year*), Terence, Plautus, and Survey of Roman Drama (*second half-year*). *Three times weekly.*
(*f*) Reading Latin at Sight and Latin Prose Composition.

G. H. WILLIAMS. *Associate Professor of Mineralogy.*
(*a*) will lecture on Mineralogy and Geology. *Three times weekly.*
(*b*) will direct the Laboratory Work in Crystallography, Physical Mineralogy and Microscopical Petrography.

H. WOOD, *Associate Professor of German.*
(*a*) will have charge of the instruction in German.
(*b*) will conduct the advanced courses in German, including the Teutonic Seminary, Gothic, Old Norse, etc.
(*c*) Béowulf. *Twice weekly, first half-year.*

W. HAND BROWNE, *Associate in English.*
(*a*) Elizabethan, Fourteenth and Eighteenth Century Writers, and early Scottish Literature. *Four times weekly.*
(*b*) Synoptical Study of English Literature. *Twice weekly.*

WILLIAM T. COUNCILMAN, *Associate in Pathology.*
(*a*) will assist in the Laboratory Work in Pathology.
(*b*) will give courses in Post-mortem Examinations and Pathological Demonstrations.

L. DUNCAN, *Associate in Electricity.*
will direct the special course in Electricity and Magnetism.

R. T. ELY, *Associate in Political Economy.*
(*a*) Finance and Taxation; Elements of Political Economy. *Each subject three times weekly.*
(*b*) Studies in Administration. *Weekly.*
(*c*) Modern Financial and Social Topics. *Twice weekly.*

F. FRANKLIN, *Associate in Mathematics.*
(*a*) Problems in Mechanics. *Twice weekly.*
(*b*) Differential and Integral Calculus. *Three times weekly.*
(*c*) Advanced Algebra and Preparation for Calculus. *Three times weekly, first half-year.*
(*d*) Theory of Equations (*first half-year*), Solid Analytic Geometry (*second half-year*). *Three times weekly.*
(*e*) Preparation for Matriculation in Trigonometry and Analytical Geometry. *Three times weekly.*

E. M. HARTWELL, *Associate in Physical Training.*
will have charge of the Gymnasium and will direct the courses in Physical Culture.

WILLIAM H. HOWELL, *Associate in Biology.*
(*a*) will assist in the Laboratory Work in Biology.
(*b*) Animal Physiology and Histology. *Three times weekly.*

J. F. JAMESON, *Associate in History.*
(*a*) Elements of Historical Criticism. *Weekly.*
(*b*) will teach undergraduate classes in History and Political Science.

A. L. KIMBALL, *Associate in Physics.*
(*a*) will direct the course of instruction for undergraduates in General Physics. *Daily.*
(*b*) will give courses of lectures to the major course students. *Daily.*

E. RENOUF, *Associate in Chemistry.*
will assist in the Laboratory Work in Chemistry.

E. H. SPIEKER, *Associate in Latin and Greek.*
Undergraduate Courses in Latin and Greek.

H. A. TODD, *Associate in Romance Languages.*
(*a*) Undergraduate Courses in French.
(*b*) Special courses in Italian, Spanish, etc.

J. W. BRIGHT, *Instructor in English.*
(*a*) Anglo-Saxon Poetry, Early English Dialects, Historical English Grammar, West Saxon and Middle English Prose Texts, and the English Seminary.
(*b*) Elements of Phonetics, History of the English Language, Anglo-Saxon, etc. *Four times weekly.*

ADDITIONAL INSTRUCTORS AND ASSISTANTS.

In Drawing: HUGH NEWELL.
In French: F. M. WARREN.
In German: J. GOEBEL and M. D. LEARNED.
In Physics: C. A. PERKINS.
In Vocal Culture: C. L. WOODWORTH, JR.

PROFESSOR R. LANCIANI, of the University of Rome, will give a course of six or more lectures (probably in January, 1887) on Roman Archæology.

M. RABILLON will give courses of public lectures (in French) on topics in French Literature.

MATHEMATICS.

PROGRAMME FOR 1886-87.

I. Graduate Courses.

PROFESSOR NEWCOMB.

Seminary.
Weekly, through the year.

Practical and Theoretical Astronomy.
Twice weekly, through the year.
This course is intended to include the theory of planetary perturbations.

DR. STORY.

Seminary.
Weekly, through the year.
The object of the Seminary is the guidance of graduate students in systematic original investigation, and for this purpose the Director suggests topics for consideration and methods of work, and the results obtained are discussed in the weekly meetings.

Introductory Course for Graduates (including Mechanics, Theory of Numbers, Modern Algebra, Higher Plane Curves, Surfaces and Twisted Curves, Quaternions, Finite Differences, Probabilities, and Elliptic Functions).
Five times weekly, through the year.
This course is preparatory to all the advanced mathematical courses, and those who intend to become candidates for the Doctor's degree in mathematics are expected to take it in the first year of their residence here as graduate students, unless they give evidence that they have already a knowledge of the several branches of the course equivalent to that here acquired. Candidates for the Doctor's degree in other departments taking mathematics as a subsidiary subject will attend three lectures a week of this course (omitting Theory of Numbers, Modern Algebra, Surfaces and Twisted Curves).

Advanced Course in Analytic Geometry.
Twice weekly, through the year.
In 1886–87 special attention will be given to the metrical properties of Curves and Surfaces, non-Euclidean Geometry, Curvature, &c.

Quaternions.
Three times weekly, through the year.

DR. CRAIG.

Seminary.
Weekly, through the year.
During the first half of the year attention will be directed mainly to the subject of the essential singular points of a function, and during the second half-year to linear differential equations, some of whose integrals are irregular, and also to the singular solutions of partial differential equations.

Hydrodynamics.
Three times weekly, first half-year.

Elasticity.
Three times weekly, second half-year.

Theory of Functions.
Three times weekly, first half-year.

Linear Differential Equations [Fuchs].
Twice weekly, first half-year.

Abelian Functions.
Three times weekly, second half-year.

Linear Differential Equations and Differential Invariants [Halphen].
Twice weekly, second half-year.

DR. FRANKLIN.

Problems in Mechanics.
Twice weekly, through the year.

The Mathematical Society.

The Mathematical Society, composed of instructors and advanced students, will meet monthly as heretofore for the presentation and discussion of papers and oral communications.

II. Undergraduate Courses.

FIRST YEAR:

Advanced Algebra and Preparation for Calculus.
Three times weekly, first half-year. DR. FRANKLIN.

Differential and Integral Calculus (elementary course).
Three times weekly, second half-year. DR. FRANKLIN.

Analytic Geometry and Conic Sections.
Twice weekly, through the year. DR. STORY.

SECOND YEAR* (after 1887).

Differential and Integral Calculus (advanced course).
Three times weekly, first half-year. DR. FRANKLIN.

Differential Equations.
Three times weekly, second half-year. DR. CRAIG.

Solid Analytic Geometry.
Twice weekly, through the year. DR. FRANKLIN.

*In 1886–87 the work of the second year will be the same as in 1885–86, *i. e.*, Theory of Equations, three times weekly, first half-year; Solid Analytic Geometry, three times weekly, second half-year; Differential Equations, twice weekly, through the year.

Preparation for Matriculation in Trigonometry and Analytic Geometry.
Three times weekly, through the year. DR. FRANKLIN.

WORK OF THE PAST YEAR, 1885-86.

Professor Newcomb:
- Practical and Theoretical Astronomy. *Twice weekly, through the year.*
- Seminary. *Weekly, through the year.*

Dr. Story:
- Seminary. *Weekly, through the year.*
- Introductory Course for Graduates. *Daily, through the year.*
- Finite Differences and Interpolation. *Twice weekly, first half-year.*
- Theory of Probabilities. *Twice weekly, second half year.*
- Advanced Analytic Geometry, with special reference to curves and surfaces of the third and fourth orders. *Three times weekly, through the year.*
- Conic Sections. *Twice weekly, through the year.*

Dr. Craig:
- Seminary. *Weekly, through the year.*
- Hydrodynamics. *Three times weekly, first half-year.*
- Theory of Functions. *Three times weekly, first half-year.*
- Elasticity. *Three times weekly, second half-year.*
- Elliptic and Abelian Functions. *Three times weekly, second half-year.*
- Differential Equations. *Twice weekly, through the year.*
- Linear Differential Equations. *Twice weekly, through the year.*

Dr. Franklin.

Problems in Mechanics. *Twice weekly, through the year.*
Theory of Equations. *Three times weekly, first half-year.*
Solid Analytic Geometry. *Three times weekly, second half-year.*
Differential and Integral Calculus. *Three times weekly, through the year.*
Trigonometry. *Three times weekly, first half-year.*
Analytic Geometry (Elementary). *Three times weekly, second half-year.*

The MATHEMATICAL SOCIETY has met monthly. Papers have been read by:

D. BARCROFT.—Note on Partitions; Generalization of Two Theorems.

T. CRAIG.—Note on Binomial Linear Differential Equations; on the Integral of the Adjoint Equation.

J. C. FIELDS.—On Forms reducible to (a, o, c), $(a, \frac{1}{2}a, c)$, (and a, b, a); a Proof of Elliptic Function Addition Theorem; new Proof of Theorem: Every Equation has a Root; a Method of Solving Riccati's Equation; Solutions analogous to Riccati's of Equation $\frac{d^n y}{dx^n} = x^m y$.

F. FRANKLIN.—On the Sum of the Squares of the Binomial Coefficients.

S. NEWCOMB.—Remarks on Complex Anharmonic Ratio; on the Combination of Errors.

W. E. STORY.—On the Parametric Representation of any Point on a Conic through Five given Points; Proof of the Theorem: The Deficiency of every Unicursal Curve is 0; a Note on Unicursal Curves; an Equation in Finite Differences; on some Quartic Scrolls not mentioned by Salmon.

PHYSICS.

PROGRAMME FOR 1886-87.

The construction of a large and commodious building to be used as the Physical Laboratory of this University is now so far advanced that the Trustees look forward to its completion in the early Autumn. Better facilities will accordingly be offered for the prosecution of studies in Physics.

The Physical Laboratory.

The new laboratory is to be of red brick, with brown stone trimmings; it is 115 feet long by 70 feet wide, and will have four stories besides the basement. In the center of the building, and below the basement are constant temperature vaults. In the basement will be the mechanical workshop, furnaces, and rooms with piers for instruments requiring great stability. The first floor will include the main lecture room which will accommodate 150 persons, and rooms for investigations in heat and electricity by advanced students.

The second floor will contain mathematical lecture rooms, studies for instructors, and a room for the mathematical and physical library of the university. The elementary laboratory will be on the third floor, which will also have a number of small rooms for the work of advanced students.

The fourth floor will be fully equipped for photographic work on the spectrum or on other physical phenomena, and will contain rooms for special investigations in light. In the tower there will be two rooms above the fourth floor, the upper of which will be provided with a telescope and dome, and will be a convenient observatory when great steadiness is not required. There will be power in the building for driving the machinery in the workshop and for running the dynamo-machines. A large section of the building set apart for the electrical laboratories will be entirely free from iron; the sash weights being of lead and the gas pipes of brass. Steadiness will be obtained for galvanometers and cathetometers by placing them on brackets attached to the walls, or on tables supported on beams independent of the floors. In some rooms there will also be piers for these instruments.

The laboratory is furnished with apparatus purchased from the best European and American makers, selected with special reference to investigations, and especially valuable for researches in electricity, magnetism, light, and heat. The electrical apparatus in particular includes one of the most complete collections of instruments in the country and will be further increased; the standards are especially valuable and accurate, and the means of reproducing them unsurpassed. The room for the dynamos, mechanical dynamometer, etc., will be at some distance from the laboratories.

The Physical Laboratory will be open for work from 9 a. m. till 5 p. m. daily throughout the year.

Statements as to Physical Courses.

The courses in Physics are arranged to meet the wants of the following classes of students:

(*a*) Those who are prepared for advanced work and wish to make Physics a specialty; (*b*) Special students in Electricity and Magnetism; (*c*) The regular undergraduates.

Graduates and others who wish to take the advanced courses and who have not already pursued the equivalent of the undergraduate course will be required to take so much of it as may seem desirable.

It is of great importance that every one who expects to take up advanced work of any kind in Physics should have a thorough mathematical foundation. Too much stress cannot be laid upon this point. The first requisite for all who expect to take more than the elementary course is that they shall acquire a good *working* knowledge of analytic geometry and differential and integral calculus; not the mere ability to follow a particular textbook, but the power to state and solve problems. Any deficiency in this respect will seriously impair the student's success, and therefore students are cautioned against entering upon special physical courses without having some natural aptitude for mathematical as well as experimental work.

It is recommended that all candidates for the degree of Doctor of Philosophy, taking Physics as their principal subject, pursue the following course:

During the first year's residence they should devote themselves to mathematics and chemistry, giving all the time they can spare to work in the Physical Laboratory. The mathematical work of this first year should be analytic mechanics and total differential equations; in chemistry at least six hours a week laboratory work besides lectures will be required.

The second and third years should be given to the regular advanced courses in physics, together with some mathematical courses, such as partial differential equations, spherical harmonics, calculus of variations, theory

of elasticity, hydrodynamics, or theory of sound. During these two years the student is expected to work constantly in the Physical Laboratory.

The above statement is made to aid the student in properly planning his course of study; variations may be made to suit individual cases.

I. Advanced Work.

For students who desire to make a special study of Physics and have already pursued an elementary course, an advanced course is provided, consisting of lectures and laboratory work.

1. *Lectures.*

PROFESSOR ROWLAND:

Electricity and Magnetism.

Four lectures weekly, through the year.

These lectures constitute one-half of a complete course which extends over two years. The other half of the course will be given during the session of 1887–88, and will embrace the subjects of Thermodynamics, Heat Conduction and Physical Optics. The lectures develop fully the mathematical treatment of the subjects mentioned, and the students who follow them should have sufficient mathematical knowledge to read such authors as Maxwell, Thomson, Briot, Fourier, Green, and Stokes.

DR. CRAIG:

Hydrodynamics.

Three times weekly, first half-year.

Elasticity.

Three times weekly, second half-year.

DR. STORY:

Mechanics (In the introductory course in Mathematics for graduates).

Three times weekly, during the first part of the year.

DR. FRANKLIN:

Problems in Mechanics.

Twice weekly, through the year.

(All special students in Physics are expected to take both the above courses in Mechanics).

2. *Laboratory Work.*

Advanced students are expected to give as much of their time as possible to laboratory work. The work consists at first in carrying out experiments which familiarize them with the use of instruments for exact measurement, and with experimental methods. When sufficient experience of this kind has been acquired the student undertakes, under the guidance of the instructors, some research designed to be of permanent value.

3. *Journal Meeting.*

All advanced students are expected to meet with the instructors once a week for the reading and discussion of the current physical journals. To each student is assigned one of these upon which to report during the year, giving a synopsis of the most important articles.

II. Special Course in Electricity and Magnetism.

With the erection of the new Physical Laboratory it becomes possible to offer a course in Electricity and Magnetism, including lectures and laboratory work extending through two years. It is intended for graduates of colleges and others who have the adequate knowledge of Mathematics, in addition to the other requirements of a good high school education. For the first year's work a knowledge of Mathematics through the differential and integral calculus, as given in the ordinary college text-books, will be required, and the instructor must be satisfied that the student is otherwise in a condition to benefit by the course.

This course will be under the immediate supervision of Dr. Louis Duncan (U. S. Naval Academy, 1880, Ph. D., Johns Hopkins University, 1885).

1*st Year.*—The lectures for the first year are intended to give the student clear physical ideas of general principles, with such mathematical interpretation as is necessary to enforce and apply them. Besides the lectures there will be a weekly meeting for the purpose of discussing articles of interest appearing in the different electrical journals.

The laboratory work will include measurements of resistance, current, potential, capacity, etc., with voltameter and calorimeter work, and the student will be familiarized with the instruments for electrical measurements, galvanometers, dynamometers, resistance coils, wheatstone bridges, condensers, etc. Toward the last of the year each member of the class will be given some experiment, bringing in the use of the methods he has already studied.

Besides the special course in electricity, the student will take the lectures in Mathematics required to fit him for the second year's work, with such other subjects as he may select—chemistry, drawing, modern languages, etc.

2*d Year.*—In the second year those parts of the theory more directly involved in the practical application of electricity will be further treated, and the theory of dynamos, motors, storage batteries, the transmission and distribution of energy, the telegraph, telephone, etc., will be given. As in the first year's course, there will be weekly meetings for the discussion of the newest developments of the subject.

The laboratory work will include the tests and running of dynamos and motors, the efficiency and practical working of storage batteries, photometer work, testing of telegraph lines, laying wires underground, experiments on the electrical transmission of energy, telephone work, etc. Sufficient time will be given for selected courses outside of the special work sketched above.

Besides the course in Electricity the student will be required to take the regular second year's undergraduate course in general physics or its equivalent.

At the end of the course, on passing the necessary examinations, the student will be given a certificate, stating that he has taken the special course in Electricity at the Johns Hopkins University, and passed the required examinations.

III. Undergraduate Courses.

The undergraduate course in Physics extends over a period of two years, both years being required of those taking it as one of their elective studies, while only the first year is necessary for those who take it as a subsidiary subject for the B. A. degree.

Laboratory work accompanies the lectures and recitations throughout the course, the design of this work being to illustrate the subject as it is studied, to impress its principles, and to give clear ideas, rather than to be merely an exercise in manipulation. But some knowledge of methods is also attained, so that in the second year problems requiring more experimental skill are given.

For admission to the first year's course in Physics, a knowledge of Plane Trigonometry and the use of Logarithms is necessary; while for the second year the student must possess a working knowledge of Analytic Geometry and Calculus.

First Year (Minor) Course.

This course does not assume that the student has had any previous acquaintance with Physics, but a knowledge of Plane Trigonometry and the use of Logarithms is required.

1. Elementary Mechanics, Heat, Electricity and Magnetism, Sound, and Light.

Lectures and recitations daily, through the year. DR. KIMBALL.

2. Laboratory work, consisting of simple experimental problems supplementing the class-room work.

Three hours weekly, through the year. DR. PERKINS.

Second Year (Major) Course.

This course is designed to meet the wants of both graduates and undergraduates who have already taken either the first year's course or its equivalent, and who wish to pursue further their physical studies. A working knowledge of Analytic Geometry and Calculus is required for admission to this course. The year's work consists of:

1. Lectures and recitations on the following subjects:

Dynamics, beginning with the study of the particle and extending to some of the simpler problems in the motion of a rigid body.

Elementary Thermodynamics based on Maxwell's Theory of Heat.

Electricity and Magnetism based on Cummings' Theory of Electricity.

Some lectures on Sound.

The Wave Theory of Light, as treated in Glazebrook's Physical Optics.

Daily, through the year. DR. KIMBALL.

2. Laboratory Work.

Four hours weekly, through the year. DR. PERKINS.

The laboratory work includes problems that present more experimental difficulties than those undertaken during the first year, or that involve more mathematical knowledge for their complete discussion; written reports are required as in the first year's course. During the year special problems are assigned to the students which they are expected to work out in a complete manner, taking necessarily more time than is required for the ordinary problems of the course.

WORK OF THE PAST YEAR, 1885-86.

The rooms devoted to the Physical Laboratory have been open daily for the prosecution of study and research, under the direction of Professor Rowland, assisted by Drs. Kimball and Perkins.

A photographic map of the solar spectrum has been completed and is now being published. The map is issued in a series of seven plates (each three feet long by one foot wide), covering the region from wave-length 3100 to 5790.

The relative wave-lengths of all the lines of the solar spectrum below *b* have been carefully measured with the view of drawing a map of that region.

The absolute wave lengths of some lines in the spectrum have been measured with great accuracy.

The wave-lengths of the lines in the cadmium spectrum have been determined.

A study of conductivity in hot air has been entered upon and is still being prosecuted.

A new dividing engine for ruling gratings has been designed and is partially constructed.

The following courses have been carried on during the year.

Professor Rowland:

Lectures on Thermodynamics, Heat Conduction, and Physical Optics. *Four times weekly, through the year.*

Dr. Kimball:

First year's course in General Physics. *Daily, through the year.*

Second year's course, consisting of lectures on Mechanics, Elementary Thermodynamics, Electricity and Magnetism, Sound, and the Wave Theory of Light. *Daily, through the year.*

Dr. Perkins:

Laboratory work of the undergraduate students through the year.

Advanced students have taken part with the instructors in weekly meetings for the discussion of the current physical journals.

CHEMISTRY.

PROGRAMME FOR 1886-87.

The courses in Chemistry are intended to meet the wants (1) of graduates who make Chemistry their specialty, or who select it as one of their subordinate subjects for the degree of Doctor of Philosophy; (2) of undergraduate students who study Chemistry for general training; (3) of special students who for good reasons have neither received a bachelor's degree nor matriculated at this University. The first and second years' courses cover the ground of General Chemistry, as far as it is possible to do so in the time occupied. Together they form the full course designed for undergraduates. Graduates and special students who have not done an equivalent amount of work will follow such parts of these courses as may seem desirable.

I. Advanced Work.

1. Laboratory Work.

Most of the work of advanced students is carried on in the laboratory, which is open to them daily, *except Saturday*, from 9 a. m. until 5 p. m. The work will consist in a thorough study of analytical processes, making difficult and typical preparations, and in carrying out investigations on assigned topics. This work is under the direction of Professor Remsen and Dr. Morse.

2. Professor Remsen will lecture twice weekly on (1) Advanced Organic Chemistry and (2) The Theories of Chemistry.

3. Dr. Morse will lecture twice weekly on Stoichiometry.

4. Special Lectures:

During the second half-year there will be a course of about twenty lectures on special topics, selected and assigned by Professor Remsen to Fellows and other advanced workers in the Chemical Laboratory.

This work, while serving to familiarize students with chemical literature, is intended also to aid them in acquiring the art of presenting subjects in the form of lectures before audiences. All those who look forward to the career of teachers of chemistry are expected to take active part in the exercises.

5. Journal Meetings.

The instructors and advanced students will meet once or twice a week for the purpose of hearing reports on the articles contained in the current journals of Chemistry.

The reports are furnished in turn by all who attend the meetings. The journals read and regularly reported upon are: Berichte der deutschen chemischen Gesellschaft; Annalen der Chemie; Journal of the Chemical Society (London); Journal für praktische Chemie; Zeitschrift für analytische Chemie; Monatshefte für Chemie; Journal of the Society for Chemical Industry; Bulletin de la Societè Chimique; Comptes Rendus; Annales de Chimie et de Physique and occasionally others.

II. First Year's Course.

This consists of laboratory work and lectures or recitations.

Introduction to General Chemistry.

Lectures and examinations five times weekly through the year (by Professor Remsen, Dr. Morse, and Dr. Renouf).

Laboratory Work.

Five hours weekly through the year (under the direction of Professor Remsen, Dr. Morse, and Dr. Renouf).

III. Second Year's Course.

The second year's course is a continuation of that just described.

Chemistry of the Compounds of Carbon.

Lectures and examinations three times weekly (by Professor Remsen).

Supplementary course in Inorganic Chemistry.

Twice weekly through the year (by Dr. Morse).

Laboratory work.

Five to six hours weekly through the year (under the direction of Professor Remsen, Dr. Morse, and Dr. Renouf).

WORK OF THE PAST YEAR, 1885-86.

The Chemical Laboratory covers an area of about 50 by 100 feet and has three full stories and a basement. In the basement are the necessary conveniences for assaying and other furnace operations. On the next floor there are large rooms devoted mainly to qualitative and quantitative analysis. On the second floor, are the rooms for research work, those of the director, the library, and a lecture-room for General Chemistry. On the third floor, are rooms for the chemical and mineralogical collections, a working and lecture-room for mineralogy, and a second lecture-room for chemistry. The laboratory will conveniently accommodate about ninety working students.

Advanced students have been engaged daily in the laboratory in prosecuting such work as seemed best adapted to the purposes of each. Those who have completed the full courses in General Chemistry, including from two to three years' work in qualitative and quantitative analysis and about a year's work in making difficult and instructive preparations, were encouraged to undertake the solution of original problems.

The following investigations have been completed during the year. Others are in progress.

Chemical action in the magnetic field.
Oxidation of aromatic substitution-products in alkaline solution.
Benzoyl-toluene-sulphon-amide and its derivatives.
Determination of the atomic weight of zinc.

The results of these investigations will soon appear in the *American Chemical Journal*. Some of them have been brought before the Johns Hopkins Scientific Association at its regular meetings.

The fellows and other advanced students have met the instructors twice a week during the year for the purpose of keeping abreast of the current chemical literature. The important journals have been carefully read, and full reports of the various articles have been made.

These students have been often called upon to treat important chemical questions in a broad way, going to the original sources and presenting the results in a complete form. In most cases the topics so investigated have been connected with the experimental work going on at the time; but other questions also have been elaborated in this way which bore less directly on the current studies. In several cases carefully written reports of the results obtained have been prepared. The excellent library of chemical books and journals which is accessible to the students in the laboratory, at all reasonable hours, has greatly facilitated the execution of this very desirable literary work.

Early in the year subjects were assigned to the Fellows and others for the preparation of lectures on various chemical topics treated historically; and fourteen such lectures were the result. These were prepared from a careful study of the original articles in the journals, and were not borrowed from books on the history of chemistry. Full abstracts of most of these lectures, furnished with complete references to the articles consulted, are to be prepared and preserved in the chemical library. The lectures given were as follows:

Three by Professor Remsen on "Baeyer's Investigations on the Phthaleins";
One by Mr. W. H. Emerson on "Investigations on the Oxidation of Ketones";
One by Mr. J. H. Kastle on "Thiophene and its Derivatives";
One by Mr. C. W. Hayes on "Fittig's Investigations on the Aromatic Hydrocarbons";
One by Mr. C. S. Palmer on "The earlier History of the Chemistry of Indigo";
One by Dr. J. R. Duggan on "Hydroxylamine";
One by Mr. J. F. Woodhull on "Nitrification";
One by Mr. W. R. Orndorff on "Rosaniline";
One by Dr. E. Renouf on "The Hydrazines";
One by Mr. R. N. Brackett on "V. Meyer's Investigations on the Nitroparaffins";
One by Mr. C. J. Bell on "Syntheses by means of Aluminium Chloride";
One by Mr. W. H. Hobbs on "The Specific Gravity of Chlorine, Bromine, and Iodine at High Temperatures";
One by Dr. E. A. Schneider on "Cinnamic Acid."

In addition, the work of the year has consisted of the courses below mentioned:

Laboratory work through the year, conducted by Professor Remsen, Dr. Morse, and Dr. Renouf.

Lectures by Professor Remsen:
General Chemistry, *three times weekly through the year.*
Chemistry of the Compounds of Carbon, *twice weekly, first half-year, and three times weekly, second half-year.*

Courses by Dr. Morse:
Physical Chemistry, *twice weekly, first half-year, and once weekly, second half-year.*
Reviews in the Chemistry of the Compounds of Carbon, *once weekly.*
Reviews in General Inorganic Chemistry, *once weekly.*

Courses by Dr. Renouf:
Reviews in General Inorganic Chemistry for elementary and for advanced students, *twice weekly.*

Courses by Dr. Williams:
Elementary Mineralogy, *once weekly.*

Seven numbers of the American Chemical Journal have appeared within the year. These are Nos. 3, 4, 5, 6 of Vol. VII., and Nos. 1, 2 and 3 of Vol. VIII.

MINERALOGY AND GEOLOGY.

PROGRAMME FOR 1886-87.

1. Lectures on Mineralogy and Geology will be given by Dr. G. H. Williams three times weekly throughout the year. These will be a continuation of the course on General Mineralogy, begun in February of the present year, and will include a consideration of the sulphates, carbonates, phosphates, and silicates.

The species of the latter group will be treated in considerable detail, with special reference to their geological importance. These lectures will be succeeded by others on Petrography (both macroscopic and microscopic), to which the mineralogy of the silicates is regarded as introductory. The course will be concluded by lectures on *Inorganic Geology*, in which especial attention will be devoted to Vulcanology, Metamorphism, and the Origin of Rocks.

The advanced course in Mineralogy will not commence again until the fall of 1887.

These lectures will be supplemented by practical work in Mineralogy and Petrography on Saturdays and, between Easter and Thanksgiving, by excursions into the surrounding country when the weather permits.

2. Laboratory work in Crystallography, Physical Mineralogy, and Microscopical Petrography, daily except Saturday, will be under the personal direction of Dr. Williams.

3. Journal Meetings will be held weekly, at which the most advanced students are expected to report on important articles relating to Mineralogy and Inorganic Geology.

WORK OF THE PAST YEAR, 1885-86.

Courses of lectures have been given by Dr. G. H. Williams on:

Mineralogy of the Silicates and Petrography. *Three times weekly, first half-year.*

General Mineralogy. *Three times weekly, second half-year.*

General Inorganic Geology. *Three public lectures.*

The History of the Taconic Controversy. *One lecture.*

The rooms of the laboratory have been open for work from 9 a. m. to 5 p. m. daily. The following investigations have been carried on in microscopical petrography:

A study of the massive and associated schistose greenstones, exposed on the Menominee River in Michigan and Wisconsin.

A study of the contact metamorphism produced by the eruptive rocks in the Animikee Slates at Pigeon Point, Minnesota.

A study of the rocks of the "Cortlandt Series," occurring near Peekskill, N. Y.

On the regular field excursions much additional information has been gathered relative to the distribution of the crystalline rocks about Baltimore, and a large number of carefully catalogued mineralogical and petrographical specimens, illustrative of the geology of the immediate neighborhood, has been added to the University collection.

Journal Meetings, at which the more advanced students have reported upon the contents of all the leading mineralogical and geological journals, have been held weekly during the last half-year.

BIOLOGY.

PROGRAMME FOR 1886-87.

I. Collegiate Instruction.

This is designed especially for undergraduate students; graduate students who have not had a thorough preliminary training will be required to follow the instruction in those subjects of the college course in which they may be deficient, before they will be permitted to undertake advanced biological studies or engage in research.

The regular course of undergraduate biological instruction extends over two years; those who take Biology as a subsidiary subject for the B. A. degree are not required to do more than the first year's work.

First Year (Minor) Course.

This has been planned to meet the needs (1) of those who intend ultimately to take up some one branch of Biology (Zoölogy, Physiology, or Botany) for special study; (2) of students, graduate or undergraduate, who expect later to study medicine, but meanwhile desire, as a valuable preparation, to obtain some general knowledge of the phenomena, laws, and conditions of life; (3) of those who desire, as a part of their general college training, some acquaintance with the methods of modern experimental and observational science, and select Biology as a subject of study with that end in view.

The course consists of five lectures or recitations weekly throughout the academic year, with laboratory work. The laboratory work takes the place of the greater part of the outside reading required in connection with most other undergraduate courses in the university. The following subjects are included in the year's work.

1. General Biology.

Three lessons or recitations weekly from the commencement of the session until the end of March.

Attention is directed to the broad characteristic phenomena of life and living things rather than to the minutiæ of descriptive Botany or Zoölogy, or to the characters of orders, genera, and species. In the laboratory the student learns how to observe, how to verify and describe what he observes, how to dissect, and how to use a microscope; he examines selected vegetable and animal types from unicellular organisms, such as the yeast-plant and Amœba, to the fern and the flowering-plant on one side and the crayfish and a mammal on the other. In the lecture room attention is mainly given to the fundamental biological facts and laws which the particular plant or animal under consideration is fitted to illustrate, the object being rather to give the student an idea of what is meant by the terms living thing, plant, animal, tissue differentiation, life history, organ, function, etc., than to teach him the elements of Botany and Comparative Anatomy as commonly understood. The organisms studied are Torula, Protococcus, Amœba, Micrococcus, Bacterium, Bacillus, Spirillum, Penicillium, Mucor, Spirogyra, Nitella, a moss, a fern, a flowering-plant, Infusoria, Hydra, starfish, earthworm, crayfish, clam, cartilaginous fish, frog, terrapin, pigeon, and rat; so that at the close of the course the student has a practical knowledge of the structure and life conditions of a typical example

from each of the main divisions of plants and animals, on which to base his reading and later studies.

2. The Embryology of the Chick and Mammal.

Three lectures or recitations weekly from the beginning of April until the close of the session, with practical study of the development of a bird.

In this course the student, who has already in his General Biology observed the natural arrangement of animals and plants in diverging series advancing from a simple bit of living matter to highly complicated organisms, studies the individual development of one of the higher animals, from its start as an almost formless bit of protoplasm to its final highly complex structure. The increasing differentiation of tissues and organs which he has noted as higher and higher plants and animals were dissected, he now sees exemplified by the chick embryo in different stages of development. At the same time a good foundation is laid for subsequent advanced study in Vertebrate Morphology.

3. Osteology, Human and Comparative.

Two lectures or recitations weekly until the end of March, with practical study on selected skeletons.

The student begins with the human skeleton, which, as the most minutely and accurately described of all conveniently accessible animal structures, is well fitted to train him to observe closely and accurately. He then studies a skeleton from each of the chief orders of the Mammalia and two or three from each of the remaining main groups of Vertebrata.

4. Plant Analysis and the elements of Systematic Botany.

Practical instruction twice weekly from the beginning of April until the close of the session.

The student is taught how to collect and preserve plants; and by the analysis of a number of flowering plants under the direction of his teacher, gets a good introduction to the terminology of descriptive botany, and learns how to use a botanical key for the recognition of species.

Second Year (Major) Course.

This is designed for those who, having completed the above minor course, desire to proceed farther with biological studies. Ultimately the second year's work in biology will be, at the choice of the student, one of three courses; in the first of these Animal Physiology will be the dominant study; in the second, Animal Morphology; in the third, Botany; for the present a choice is offered only between the first and second of the three.

[To complete a major course a student must, after finishing his minor, take either 1, 2, and 3, of the subjects below named, or 2, 3, and 4. The former combination is recommended to those who intend afterwards to study medicine].

1. Mammalian Anatomy.

Twice weekly, until Christmas.

In connection with this course the student dissects thoroughly one of the higher mammals. He thus acquires a knowledge of the names, general distribution and structure of nearly all the muscles, nerves, vessels and viscera, and becomes fitted to take up profitably the study of mammalian physiology and is prepared for professional study of the details of descriptive and regional Human Anatomy; and so saves much time if he subsequently enters a medical school.

2. Animal Physiology and Histology.

Three lectures or recitations weekly during the year.

This course is designed to give the student a good knowledge of the properties and mode of working in health of the various tissues and organs of the higher animals, man included; also to give him a good knowledge of their microscopic structure. It thus prepares the student for subsequent study of Pathology and Pathological Histology. In the laboratory each student examines for himself the histology of each organ and tissue, and thus learns the use of reagents and embedding materials, the methods of cutting and mounting sections, etc.; he also studies practically the composition of the more important organs and tissues, the chemistry of digestion, the fundamental properties of living muscles and nerves, the beat of the heart, the phenomena of reflex action, etc. Important physiological facts, which require special skill for their exhibition or the employment of especially delicate instruments, are demonstrated to the class. There will be, as a rule, two such demonstrations weekly. No painful experiments are performed in connection with this course.

The physiological apparatus belonging to the University is unusually good and complete; students have, accordingly, not only the opportunity to acquire a knowledge of the methods of modern histological investigation, but also of the mode of using all the chief instruments employed in physiological, pathological, and pharmacological research.

3. Elements of Zoölogy.

Two lectures or recitations weekly from the Christmas recess until the end of the academic year.

A systematic course of lectures on the structure, relationships, and classification of animals. In the laboratory the student will dissect a number of forms selected to supplement the types studied in the General Biology course of the first year in Biology.

These forms are—

Calcareous sponge; tubularian hydroid; hydro-medusa; actinia; sea urchin and its development; holothurian: polychaetous annelid; leech; distoma; copepod; barnacle; crab and its metamorphosis; limulus, scorpion; grasshopper; gasteropod; cephalopod; lingula; ascidian; amphioxus; teleost; lizard.

4. Marine Laboratory.

At least two months' study at the marine laboratory of the University between June 1st and August 31st.

This may be taken in one year or a month may be taken in each of two consecutive years.

II. University Instruction and Opportunities.

This is designed for graduates who have already such knowledge of Biology as might be obtained by following the collegiate major course in that subject, and for others who, although not graduates, satisfy the university authorities that they are competent to undertake advanced work. In the university courses but little of the teaching is given by formal lectures; the instructors come into close daily contact with the students, supervise their work, direct their researches, and advise as to their reading.

1. Animal Physiology.

The biological laboratory has been especially constructed with reference to providing opportunity for advanced work in experimental physiology. The collection of physiological instruments belonging to the University is unusually large and complete and is yearly added to,—the trustees providing an annual sum for the purchase of instruments wanted for any particular investigation, or which for other reasons it is desirable to have in the laboratory. There is also a workshop in the laboratory in which a skilled mechanic is kept employed repairing and constructing instruments. The laboratory contains two large rooms for general advanced work in animal physiology, in addition to others specially designed for work with the spectroscope, with the myograph, for electro-physiological researches, and for chemical physiology.

2. Animal Histology.

The laboratory contains a special room constructed for advanced histological work, and well supplied with apparatus and reagents. There is also a room and apparatus for micro-photography.

3. Animal Morphology.

Rooms for advanced work in this subject are contained in the laboratory and a course of advanced lectures is given by Dr. Brooks. The chief advanced study in animal morphology is however carried on at the Marine Laboratory, open at the sea-side from the beginning of June until the end of August, under the direction of Dr. Brooks. The Marine Laboratory possesses a steam launch and a large sloop, and is supplied with dredges, boats, aquaria, microscopes, etc.

4. Physiological Psychology.

During the academic year a course of lectures, combined with laboratory work, will be given by Dr. G. Stanley Hall, in connection with the psychological courses of instruction in the university.

5. Lectures.

Professor Martin will lecture weekly to advanced students on selected topics in Physiology. Dr. Brooks will conduct a class for advanced students in Animal Morphology. Short courses of lectures will be given from time to time on other selected physiological and morphological subjects.

6. Journal Club.

A Journal Club, composed of the instructors and advanced students, meets weekly for the reading and discussion of recent biological publications.

7. Reading Clubs, in Animal Morphology and Physiology, for the study and discussion of classical biological works, meet weekly during the greater part of the session.

8. Library Facilities.

The laboratory contains a library supplied with standard biological works and complete sets of the more important journals. There is also a special collection of books which have been brought together in connection with researches carried on in the laboratory. An effort is always made to procure for anyone engaged in a particular investigation all publications bearing on his work but not easily accessible, as graduation theses, occasional publications from laboratories in Europe and elsewhere, etc. The biological library receives regularly about forty biological periodicals, including all the important physiological and morphological journals in English, French, German, and Italian.

The general library of the university receives all the chief journals of general science, and the transactions of all the leading learned societies of the world.

The library of the Peabody Institute, within five minutes' walk of the university, contains complete sets of many of the chief biological journals, of the proceedings of learned societies, and other works of reference.

In the library of the Medical and Chirurgical Faculty of Maryland, a very large number of medical periodicals is accessible to members of the university.

The proximity of Washington is of special value to advanced students of physiology. The library of the Army Medical Museum in that city contains an almost unrivalled store of physiological works, which are available under conditions favorable to study.

9. Publication.

In connection with the biological laboratory there is published a journal (*Studies from the Biological Laboratory*) which contains the results of most of the researches carried out in the laboratory; a ready means of publication for original work is thus secured. The *University Circulars*, which appear at short intervals throughout the year, are available for preliminary statements, securing priority for discoveries while more detailed accounts are in course of publication.

III. Naturalists' Field Club.

This was organized by members of the University, but includes in its list of members other residents of Baltimore interested in Natural History. The club works in three sections—Geology and Mineralogy, Zoölogy, Botany. Each section elects its own officers and arranges for its own field excursions and its own meetings. There are also monthly meetings of the whole club, when the chairmen of the different sections report progress and an address on some topic of Natural History is given by one of the members.

The mineralogical collections of the club are preserved in the Chemical Laboratory; the botanical and zoölogical in the Museum of the Biological Laboratory.

WORK OF THE PAST YEAR, 1885-86.

I. Laboratory Work.

The Biological Laboratory was open for eight hours, five days weekly, during the academic year, for the prosecution of advanced study and research and for practical instruction in connection with class lectures.

During the year original investigations have been made in regard to the following subjects:

The mode of action of pepton and Leech extract in checking blood coagulation. The so-called new "element" of the blood, and its relation to coagulation. The influence of the "pneumatic cabinet," on circulation and respiration. The action upon the mammalian heart of the following drugs of the "atropin group," viz.: Hyoscyamine, Hyoscine, Coniine, Daturine, Homatropine, Atropine; also of the following members of the "digitalis group," viz.: Sparteine, Evonymin, Adonidine, Erythrophlæine. The comparative action upon the mammalian heart of methyl, ethyl, propyl, butyl, and amyl alcohols. The transformation of sugar in the liver. The morphology and embryology of the Stomatopoda collected by the Challenger expedition. Origin of alternation of generations in Hydro medusæ. Morphology and embryology of the Anuelida of Beaufort, N. C. Embryology of Insecta and Arachnida. The budding of the Tunicata. Germinal layers of the mouse embryo. Morphology of Cheiropsalamus. Embryology of the Decapod Crustacea. Embryology of the marine Prosobranch Gasteropods. Morphology of the Actiniæ found at Beaufort, N. C.

The results of some of the above researches have already been published. Preliminary notices of the results of many of the remainder have been printed in the *University Circulars*, in the *Zoologischer Anzeiger*, and elsewhere. Fuller accounts will shortly be published.

In connection with the regular class instruction, first year students studied a number of typical fungi, green plants, and animals; the skeletons of about twenty selected vertebrates; and the development of the chick in the egg. In the spring there were fifteen practical lessons in the elements of Systematic and Descriptive Botany.

Second year students worked at the histology of the tissues and organs of the higher vertebrata (especially man); the physiological properties and functions of the tissues and organs; the physiology of digestion; the chemistry of bile, urine, etc. The cat was thoroughly dissected by the second year students, and about twenty-five selected invertebrate and vertebrate types examined.

II. Advanced Instruction.

Dr. W. K. Brooks lectured twice weekly through the year on Advanced Morphology.

A course of fifteen lectures on Morphological Problems was given during April and May, as follows:

H. V. Wilson. On the Affinity and Phylogeny of the Cubo-medusae as illustrated by the Anatomy and Histology of Cheiropsalamus.

G. B. Haldeman. On the Inversion of the Germ Layers of Rodents.

A. T. Bruce. On the Embryology of Insects. (Two lectures).

E. A. Andrews. Asexual Multiplication of Annelids.

H. Orr. Asexual Multiplication of Tunicata.

W. K. Brooks. On Asexual Multiplication.

F. H. Herrick. On the Development of the Crustacea.

J. Nelson. Methods of Reproduction in relation to the problem of Sex. (Several lectures).

J. P. McMurrich. The Embryology of Gasteropods.

Dr. W. H. Howell gave twenty-five advanced lectures on the Physiology of Respiration.

Most of the advanced work was carried on individually, and not in class; each worker taking up some special topic for study

under the immediate direction of some one of the instructors. In addition to the original researches already enumerated, certain graduate students have in this manner carried on advanced study in various directions.

Students engaged in this kind of study (which forms a stepping-stone between class-work and original research) are usually given some important original article, and shown how to repeat and verify for themselves (and criticise) the experiments and results described in it. By studying and repeating the original work of others they learn the methods of biological investigation, and are thus trained to plan and carry out researches themselves. In connection with this work, students are also taught how to hunt up and utilize the bibliography of a subject.

III. Class Instruction.

Courses of lectures for undergraduates were given as follows:

Osteology, *twice weekly, until the end of March.*
Mammalian Anatomy, *twice weekly, until Christmas.*
Animal Physiology and Histology, *three times weekly through the year.*
General Biology, *three times weekly, until the end of March.*
Embryology of the Chick and Mammal, *three times weekly, from the first of April until the close of the session.*
Plant Analysis, *twice weekly, in April and May.*

IV. Marine Laboratory.

During the summer of 1885, the seaside Zoölogical Laboratory for the study of forms of marine life, was open at Beaufort, N. C., for fifteen weeks.

The advanced work included original investigations on the following subjects:

The metamorphosis of Limulus polyphemus. Embryology of Limulus polyphemus. Chemical composition and coagulation of the blood of Limulus polyphemus, Callinectes hastatus, and Thyonella gemmata. The post-oral cilia of Gasteropod veligers. The rhythm and innervation of the heart of the sea turtle. The physiology of the heart of the alligator. The cardiac rhythm of fishes and the action on the same of various drugs and poisons. Origin of the endoderm in Lepidoptera. The propagation and cultivation of oysters in floats.

The results of many of these investigations have been already published; others will be shortly.

The Marine Laboratory is located, during the summer of 1886, at the Island of Abaco in the Bahamas.

V. Publications.

Numbers 5, 6 and 7 of the third volume of "*Studies from the Biological Laboratory*" have been published during the year. They contain:

Development of the Gill in Fasciolaria, with one Plate. By Henry Leslie Osborn, Ph. D.

A Study of the Structure of Lingula (Glottidia) Pyramidata, *Stim*, (Dall), with four Plates. By H. G. Beyer, M. D., M. R. C. S.

Observations upon the Blood of Limulus Polyphemus, Callinectes Hastatus, and a species of Holothurian, with one Plate. By W. H. Howell, Ph. D.

Note on the Presence of Haemoglobin in the Echinoderms. By W. H. Howell, Ph. D.

On the So-called "New Element" of the Blood and its Relation to Coagulation, with one Plate. By Geo. T. Kemp, A. B.

The Life History of Thalassema, with four Plates. By H. W. Conn, Ph. D.

PATHOLOGY.

PROGRAMME FOR 1886-87.

The Trustees of the Johns Hopkins Hospital have allowed the use of the Pathological building, on the Hospital grounds, for the prosecution of pathological studies. It has ample accommodations and will be thoroughly equipped at the beginning of the next academic year.

Systematic instruction in Pathology will be given in this Laboratory during the academic year 1886-87. No one will be admitted to the courses in Pathology who has not a fair knowledge of the normal anatomy, histology, and physiology of man. The following courses of instruction will be given:

1. Pathological Histology by PROFESSOR WELCH and DR. COUNCILMAN.

This course begins November 1, 1886, *and continues three days weekly for four months.*

The course includes the preparation and the study of diseased tissues and organs. Attention will be given to the subjects both of General and of Special Pathology. The laboratory is furnished with a rich collection of pathological specimens for purposes of microscopical study.

2. Demonstrations in Pathological Anatomy by DR. COUNCILMAN.

This course begins November 1, 1886, and consists in weekly demonstrations of fresh pathological specimens.

3. Method of making Post-mortem Examinations by DR. COUNCILMAN.

Instruction in this subject will be given at the Bay View Hospital.

4. Bacteriology by PROFESSOR WELCH.

Daily during March and April, 1887.

The methods of isolating and of cultivating micro-organisms and the morphological and the biological properties of the most important species, particularly of the pathogenic forms, will be taught. The laboratory is supplied with a complete set of apparatus for bacteriological work.

5. Lectures on the General Pathology of Fever by PROFESSOR WELCH.

Once a week during February, March, and April, 1887, *in Hopkins Hall.*

The Pathological Laboratory is ready for the reception of physicians or of advanced students who, after suitable preliminary training, wish to undertake special research in any branch of General or of Special Pathology, including Experimental Pathology and Bacteriology.

A Fellowship in Pathology yielding five hundred dollars in addition to free tuition will be granted in October 1886, if a suitable candidate applies.

The application must be made prior to October 1. The candidate must give evidence of a liberal education (including especially physics, chemistry, biology, and modern languages) and of special aptitude for pathological study, such as that afforded by some previous scientific work. The holder of the fellowship will be expected to devote his time to some special line of investigation (not strictly professional) under the direction of the Professor of Pathology. Further information concerning the purposes and the regulations of University fellowships is contained in the Annual Register.

ANCIENT AND MODERN LANGUAGES.

PROGRAMMES FOR 1886-87.

GREEK.

I. Greek Seminary.

PROFESSOR GILDERSLEEVE will conduct the Greek Seminary, the plan of which is based on the continuous study of some leading author or some special department of literature.

The Seminary consists of the director, fellows, and scholars, and such advanced students as shall satisfy the director of their fitness for an active participation in the work by an essay, a critical exercise, or some similar test of attainments and capacity. All graduate students, however, may have the privilege of attending the course.

During the next academic year the study of Aristophanes and the Old Attic Comedy will constitute the chief occupation of the members. There will be two meetings a week during the entire session, one for the criticism and interpretation of the author, one for auxiliary studies in the literary and political history of the period.

In connection with the Seminary the director will give a course of twelve lectures on the Metres of Aristophanes.

II. Advanced and Graduate Courses.

1. PROFESSOR GILDERSLEEVE will also conduct a course of Practical Exercises in Greek, consisting chiefly in translation at dictation from Greek into English, and English into Greek, two meetings a week from the beginning of the session to the first of January.

2. He will give a series of readings in Aischylos, Sophokles, and Euripides with special reference to theories of tragic art twice a week after January 1.

3. Further, a general introduction to Hermeneutics and Criticism once a week after January 1.

The student should be provided with Bergk's or Meineke's complete text, von Velsen's critical edition so far as issued, and Kock's editions of the Knights, Clouds (tr. by Humphreys), Birds, and Frogs.

The student should also possess Kock's Fragmenta Comicorum Graecorum or Meineke's smaller edition of the Fragments, and for the study of the period Thukydides, Xenophon's Memorabilia and Hellenika, and Plutarch's Lives of Perikles and Alkibiades.

4. Notice as to other courses is reserved.

III. Undergraduate Courses.

1. Lysias, *Select Orations.*
   Four times weekly, first half-year. DR. SPIEKER.
   Private Reading: Xenophon, *Hellenica, books i and ii.*

2. Homer, *Odyssey, three books;* Euripides, *Hippolytus.*
   Four times weekly, second half-year. DR. SPIEKER.
   Private Reading: Herodotus, *Merry's Selections.*

3. Aeschylus, *Prometheus Vinctus;* Sophocles, *Antigone;* Survey of the Greek Drama.
   Four times weekly, first half-year. PROFESSOR WRIGHT.
   Private Reading: Euripides, *Medea;* Aristophanes, *Clouds.*

4. Demosthenes, *De Corona;* Survey of Greek Oratory.
   Four times weekly, second half-year. PROFESSOR WRIGHT.
   Private Reading: Aeschines, *De Corona;* Lycurgus, *in Leocratem.*

5. Prose Composition.
   Weekly exercises in connection with each of the above courses.

6. Topics in Classical Archæology and Antiquities.
   A series of conferences once a week throughout the year. PROFESSOR WRIGHT.

7. Conferences on Greek Syntax.
   A series of conferences once a week for the last three months. PROFESSOR GILDERSLEEVE.

LATIN.

I. Latin Seminary.

DR. WARREN will conduct the Latin Seminary. Vergil has been chosen as the centre of work for the next academic year. There will be two meetings a week during the entire session, devoted to critical interpretation, to auxiliary studies and to the presentation of papers by the members of the Seminary.

Students are advised to provide themselves in advance with a text edition of Vergil including the Carmina Minora (either Ribbeck, Haupt, or Paldamus), with Eyssenhardt's edition of Macrobius, and Lion's edition of the Commentary of Servius to Vergil.

II. Advanced and Graduate Courses.

1. During the first half-year, DR. WARREN will give a course of lectures on topics connected with Vergil and Roman epic poetry.

2. During the first half-year, he will read Macrobius with a class once weekly.

3. During the second half-year, he will give a course of lectures on Latin Palaeography, with practical exercises in reading facsimiles of manuscripts.

4. During the second half-year he will hold a series of weekly conferences on Latin Syntax.

III. Undergraduate Courses.

1. Livy, *two books.*
   Four times weekly, first half-year. DR. SPIEKER.
   Private Reading: Cæsar, *Bellum Civile, books i and ii;* Cicero, *de Amicitia.*

2. Horace, *Select Odes, Satires, and Epistles.*
   Four times weekly, second half-year. DR. SPIEKER.
   Private Reading: Horace, *Epodes;* Ovid, *Tristia, Book i.*

3. Cicero, *Orator, Oratio pro Plancio;* Survey of Roman Oratory.
   Three times weekly, first half-year. DR. WARREN.
   Reading at sight.
   One hour weekly.
   Private Reading: Cicero, *Brutus.*

4. Terence, *Andria;* Plautus, *Trinummus;* Survey of the Roman Drama.
   Three times weekly, second half-year. DR. WARREN.
   Reading at sight.
   One hour weekly.

Private Reading: Terence, *Hautontimorumenos;* Plautus, *Captivi.*

5. Tacitus, *Germania, Annales, books ii and iii.*
Four times weekly, second half-year.
Private Reading: Tacitus, *Agricola, Histories book i.*

6. Prose Composition.
Weekly exercises in connection with each of the above courses.

SHEMITIC LANGUAGES.

PROFESSOR HAUPT will give the following courses:

1. Critical Interpretation of selected Psalms.
Wednesday, 3 p. m.
Liber Psalmorum ed. Baer and Delitzsch, Lipsiae 1880 (Tauchnitz).

2. Hebrew Exercises: Reading unpointed texts at sight.
Wednesday, 4 p. m.
Liber Genesis sine punctis exscriptus, cur. Muehlau & Kautzsch, editio altera, Lipsiae 1885.

3. Biblical Aramean Grammar for beginners and Interpretation of the Chaldee portions of the book of Daniel.
Thursday, 10 a. m.
Libri Danielis, Ezrae et Nehemiae ed. Baer, Lipsiae 1882; Kautzsch, *Grammatik des Biblisch Aramäischen*, Lipsiae 1884.

4. Assyrian for beginners: Elements of Assyrian Grammar and exercises in deciphering cuneiform texts.
Thursday, 3–5 p. m.
Delitzsch *Assyrische Lesestücke*, 3d. ed. Leipzig 1885.

5. Assyriological Exercises for advanced students.
Thursday, 12 m.

Should a sufficient number of applicants send in their names there will be given a Hebrew course especially intended for clergymen to which other students will not be admitted.

In addition to the above-mentioned courses elementary instruction in Hebrew, Syriac, Arabic, and Ethiopic, should there be any demand, will be given by the Fellows in Shemitic Languages under the supervision of Professor Haupt.

For the month of January, 1887, it is proposed to interrupt the regular course and devote all the time exclusively to Assyriology. Professor Haupt will give twenty-four lectures on Assyrian language and literature, interpreting the cuneiform texts in the third edition of Delitzsch's *Assyrische Lesestücke* (Leipzig, 1885). There will be also two hours daily by the Fellows in Shemitic Languages to assist those who are pursuing the course. A special programme of this proposed *Assyriological Winter School* will be mailed to applicants at the beginning of next session, October, 1886.

SANSKRIT AND THE COMPARATIVE GRAMMAR OF THE COGNATE LANGUAGES.

DR. BLOOMFIELD will give the following courses:

1. Sanskrit. (*First year*).
Perry's Primer (translations from Sanskrit into English, and English into Sanskrit).—Whitney's grammar and the selections from the *Nala* and the *Hitopadeça* in Lanman's reader. *Twice weekly, through the year.*

2. Sanskrit. (*Second year*).
a. Selections from the *Kathā-sarit-sāgara* and the *Mānava-dharma-çāstra.*
b. Introduction into the *Rig-Veda.*
Twice weekly, through the year.

3. Vedic Sanskrit. (*Third course, supplementary to the first two years*).
Continuation of the course in the *Rig-Veda*, and selections from the *Brāhmaṇas* and *Sūtras. Weekly, first half-year.*

4. Vedic Sanskrit. (*Seminary*).
The fourth book of the *Atharva-Veda*, accompanied by the corresponding passages in the *Kāuçika-sūtra*, along with its commentary by *Dārila*, and other liturgical literature in the original MSS. *Weekly, through the year.*

5. General Principles of Comparative Philology.
a. Lectures on *phonetic law and analogy, agglutination, the questions attaching themselves to the relationships of languages*, etc.
b. Whitney's "Language and the Study of Language."
Weekly, through the year.

6. Comparative Greek Grammar.
a. Twelve lectures on the present position of the theory of agglutination.
b. Greek Inflections on the basis of Karl Brugmann's *Gricchische Grammatik.*
Weekly, through the year.

GERMAN.

I. Advanced Courses.

Dr. Wood will give the following courses:

1. Teutonic Seminary.
The work in Low German, begun last year, will be continued during the first half-year. Lauremberg's *Niederdeutsche Scherzgedichte* (1652), will be read, and a number of selected texts from Franck's *Mittelniederländische Grammatik mit Lesestücken*, Leipzig, 1883. During the second half-year the study of the Allemannic dialect will be begun, and will centre in Thomas Platter's *Selbstbiographie* (XVI. cent.). Leipzig, 1878.

2. Gothic.
Braune's *Grammar*, Bernhardt's *Wulfila. Halle* 1884.
Twice weekly, first half-year; weekly, second half-year.

3. Old Norse.
The Edda. *Twice weekly, second half-year.*

4. German Comparative Grammar.
Twice weekly, through the year.

5. Middle High German.
Nibelungen Lied. Twice weekly, second half-year.

6. Bëowulf.
[See English Courses, p. 126].

There will be a weekly meeting of all the students following courses in the Teutonic Languages, for discussions and reports on the contents of journals, and for the presentation of original papers, notes, etc.

II. Undergraduate Courses.

Collegiate courses will be conducted as follows:

Minor (First Year) Class A.

1. Classics.
Three times weekly.
Goethe, *Egmont*; Schiller, *Maria Stuart*; Lessing, *Minna von Barnhelm.*

2. Historical Readings.
Twice weekly.
Freytag, *Bilder aus der deutschen Vergangenheit III* (*Aus dem Jahrhundert des grossen Krieges*); Riehl, *Kulturgeschichtliche Novellen.*
There will be a course of parallel readings, centering in the Thirty Years' War.

3. Scientific Readings.
Twice weekly.

4. Prose Composition.
Weekly.
5. Oral Practice.
Weekly.
Based upon readings and exercises.

Students may choose the classes making up the Minor Course, under the direction of the instructor. Thus a complete course may consist of Nos. 1, 4, 5; or 2, 4, 5, and one hour of 1; or of 3, 4, 5, and one hour of 1.

Minor (First Year) Class B.

This class is in place of the regular German Minor Course for students who have passed the matriculation examination in Greek. It is also recommended for graduates beginning German.

1. Otis: Elementary German.
Daily, first six weeks.
After the completion of the above, the work for the remainder of the year is divided as follows:
2. Lessing, *Minna von Barnhelm*; Schiller, *Wilhelm Tell.*
Twice weekly.
3. Miscellaneous Selections in Prose.
Twice weekly.
4. Prose Composition.
Weekly.

Major (Second Year) Course.

1. Classics.
Twice weekly.
Goethe, *Hermann and Dorothea, Iphigenia, Faust I*; Schiller, *Wallenstein.*
2. Middle High German.
Weekly.
Selections from the *Nibelungen Lied, Gudrun*, etc.; lectures on the chief Teutonic epic cycles, with illustrations.
3. Selected Readings.
Marius's Lesebuch III. Weekly.
The selections are made from historical, scientific, and miscellaneous prose. Students may, with the advice of the instructor, choose between this course and the preceding.
4. Prose Composition.
Weekly.
5. German Literature.
Weekly,
Lectures and Readings with Kluge's *Geschichte der deutschen Literatur.*
6. Exercises in German Style and Syntax.
Monthly.

Classes in German Conversation meet daily through the year.

Supplementary Class.

Otis's *Elementary German*; Buchheim's *Modern German Reader I*; Schiller's *Lied von der Glocke* ed. Otis. Twice, and three times in alternate weeks. This class prepares undergraduates for entering the Minor Course.

ENGLISH LANGUAGE AND LITERATURE.

I. Advanced Courses.

Dr. Bright will conduct advanced courses as follows:

1. Anglo-Saxon Poetry.
Lectures and the reading of texts. *Twice weekly.*
2. Early Dialects.
Lectures and the interpretation of Sweet's "Oldest English Texts."
Twice weekly.
3. Historical English Grammar.
Lectures. *Weekly.*
4. West Saxon and Middle English Prose Texts.
Weekly.
5. The English Seminary.
Advanced students will be brought together in bi-weekly sessions of two hours, for the presentation and discussion of the results of their own research in literary and philological subjects, and for reports on the current journals pertaining to English.

Dr. Wood will conduct a course in *Béowulf, twice weekly, first half-year.*

II. Undergraduate Courses.

Minor (First Year) Course.

1. Elizabethan Writers.
Twice weekly, first half-year. Dr. Browne.
2. Fourteenth Century Writers.
Twice weekly, second half-year. Dr. Browne.
3. Eighteenth Century Writers.
Once weekly, through the year. Dr. Browne.
4. Elements of Phonetics.
Once weekly, first half-year. Dr. Bright.
5. History of the English Language.
Once weekly, second half-year. Dr. Bright.
6. Elementary Anglo-Saxon.
Once weekly, throughout the year. Dr. Bright.
7. Essays by Students.

Major (Second Year) Course.

1. Anglo-Saxon.
Once weekly, throughout the year. Dr. Bright.
2. First English Literature (Ninth to Eleventh Centuries).
Once weekly, throughout the year. Dr. Bright.
3. Early English (Twelfth and Thirteenth Centuries).
Twice weekly, throughout the year.
4. Early Scottish Literature.
Once weekly, throughout the year. Dr. Browne.
5. Essays by Students.

English required of all undergraduates.

Synoptical study of English Literature (in P. H. E. Course).
Twice weekly, through the year. Dr. Browne.

Summary of English Courses.

Advanced Courses. These courses are intended to meet the requirements of those who are aiming at special scholarship in English. Methods are employed by which the labors of past and contemporary scholars are made available, and by which the student may be led to individual research.

Anglo-Saxon and Middle English. The student will at once begin the grammatical study of the oldest period of English, and in the first year will be required to do the work represented by Sweet's *Anglo-Saxon Reader.* The next year he will pass to the more exact study of the leading Anglo-Saxon dialect (West-Saxon), using Sievers' *Old English Grammar*, edited by Prof. Cook, and reading a good portion of the best West-Saxon prose (such as Sweet's ed. of Alfred's *Orosius*); some of the minor poems (Wülker's *Kleinere Angelsächs. Dichtungen*); and later Anglo-Saxon miscellaneous prose (*Homilies*, etc.). The Grammar will be supplemented by constant regard to the subsequent development of the language in forms and syntax. The course in English of the twelfth and thirteenth centuries, carried on simultaneously, will connect organically with Anglo-Saxon on the one side, and with the language of Chaucer on the other.

Elements of Phonetics. In accordance with the doctrine that growth and changes in language rest upon the two-fold basis of physical and psychical laws, and that mental analogies only occasion phonetic possibilities, the elements of the science of the physical production of speech are introduced at the beginning of this course, where the student's own vernacular can be employed in direct practical application of the principles involved. The student will be taught to realize in practice the phonetic categories of language, and thus to arrive at a living definition of the terminology of the grammarian. Observation in this field will be restricted, primarily, to his own pronunciation, and to the various phases of his own language, and secondarily, to the next best known phenomena of German and French. A foundation will thus be laid for the more exact methods in the subsequent work of the course in Modern Languages.

History of the English Language. The outlines of this subject are imparted by means of text-books, supplementary lectures, and "private readings." The aim is to enforce in a clear and orderly manner a sense of the historic continuity of the English Language.

First English Literature. The literature of the Anglo-Saxon period will be studied upon the basis of the treatise of ten Brink, amplified by the results of modern investigation and criticism.

English Literature. It will be seen that in the literary part of these courses the same idea of continuity prevails that is emphasized in the linguistic part. The student is first given a synoptical view of the whole field. In the major and minor courses the most important periods of literary production are studied, from the ninth century to the nineteenth. From the fourteenth century down, the history, manners, political and religious conditions, etc., of the people, are explained sufficiently to indicate the position of the chief writers of each period, and the influences under which they wrote.

For the fourteenth century, the central work will be in Chaucer and Langland; for the Elizabethan period, in Shakespeare; for the eighteenth, in Pope and the Essayists.

The essays required of students are intended to promote the attainment of a good English style. The instructor is thus enabled to see the defects of each writer, and to give him the help and counsel that he needs, instead of laying down general principles from the lecturer's desk.

P. H. E. Course. The object of the English portion of the required course in Physical Geography, History, and English, is to present a view of English Literature as a whole, preparatory to more critical study. Stopford Brooke's *Primer of English Literature* is recommended for reference. The books necessary for reading in class will be announced by the instructor.

ROMANCE LANGUAGES.

I. Advanced Courses in Romance Philology.

The work in Romance Philology for properly qualified students extends through three years. It is intended primarily for Graduate Students and is specially adapted to the training of teachers and specialists. Students who enter for the later years of the course must show that they are acquainted with the subjects previously studied, and those who begin the course must give evidence of familiarity with Latin, Modern French, and German.

Mr. Elliott will give the following courses:

1. With first year graduate students.

First Half-Year:

(*a*) Lectures on Modern French Phonetics. *Weekly.*

(*b*) The History of Romance Studies in Europe. *Weekly.*

Second Half-Year:

(*c*) Introduction to Old French Philology. *Aucassin et Nicolète* (Suchier's edition). *Weekly.*

2. With second and third year graduate students.

(*a*) Seminary work.
This will centre here in the earliest Old French Monuments (*Serments de Strasbourg, Cantilène de Sainte Eulalie, Fragment de Valenciennes*). *Two hours weekly.*

(*b*) Comparative Romance Phonology. *Weekly.*

(*c*) Old French Syntax. *Weekly.*

(*d*) Italian Dialects. *Weekly.*

(*e*) Pro-Seminary. *Weekly.*

(*f*) Old French Paleography. *Weekly, second half-year.*

II. Special Courses in Italian, Spanish, etc.

(These courses are planned to meet the wants of graduate students in Romance Languages in their first academic year.)

1. Italian.
The class in Italian will begin with the Italian Principia, Parts I. and II., and will read later Leopardi (*Versi e Prose*); Romussi (*Storia d'Italia*) and Goldoni (*La Sposa sagace*). Dr. Todd will interpret Dante's *Paradiso* one hour weekly through the year.

2. Spanish.
The class in Spanish will begin with Knapp's Grammar and Readings and will continue with *El Poema del Cid* (XII. century) and *Don Quijote.*

3. Portuguese.
In Portuguese the class will begin with Lencastre's *Nouvelle Méthode Portugaise,* and will read later Herculano (*O Monge de Cistér*) and Camoens (*Os Lusiadas*).

4. Raetian, Catalan and Old Provençal.
In Raetian the text-books used will be Ulrich's *Rhätoromanische Chrestomathie* and Andeer's *Rhätoromanische Elementargrammatik* (with Gartner's *Grammatik* for reference). The text-book in Catalan will be Cardona's *Dell' antica Letteratura Catalana.* Bartsch's *Chrestomathie provençale* will be used in the study of Old Provençal.

5. Wallachian.
Cionca's *Practische Grammatik.*

III. Undergraduate Courses in French.

I. (Minor, First Year, Course).

1. Literary.
Sainte Beuve, *Causeries du Lundi*; Selections from Daudet, Dumas, *fils,* Théophile Gautier and Guizot; Victor Hugo, *Ruy Blas. Twice weekly.*

2. Historical.
Voltaire, *Siècle de Louis Quatorze. Weekly.*

3. Scientific.
Luquiens, Course in Scientific French. *Weekly.*

4. Prose Composition.
Chardenal's Advanced Course. *Weekly.*

II. (Major, Second Year, Course).

1. Lectures on French Literature.
(Mediæval and Classical). *Weekly.*

2. Classical French (XVII century).
Corneille, *Horace*; Racine, *Athalie*; Molière, *Le Bourgeois Gentilhomme* and *Les Precieuses Ridicules. Weekly.*

3. Old French.
Bartsch's *Chrestomathie. Twice weekly, first half-year.*

4. Middle French.
Darmesteter and Hatzfeld, *Morceaux Choisis. Twice weekly, second half-year.*

5. French Composition.

Gasc's Prose Composition, *Weekly, first half-year.* Original essays, *Weekly, second half-year.*

Opportunity for training in French pronunciation and conversation will be given, a special class meeting for this purpose three hours weekly throughout the year.

WORK OF THE PAST YEAR, 1885-86.

Greek.

Under the direction of Professor Gildersleeve the advanced students of Greek have been organized into a Greek Seminary. According to the plan of the seminary the work of the year is concentrated on some leading author or some special department of literature, chiefly with reference to the literary form. During the past year the centre of work was Plato.

In the seminary proper, which met once a week during the academic year, the Euthydemos, the Theaitetos, and the Phaidros were interpreted by the members in turn. Papers were presented, read, and discussed on the unity of Plato's Republic, on Dionysios' criticism of Plato's style, on the myth in Plato, on Plato's use of comparisons, on the peculiarities of the Timaios.

One of the members has been engaged in an elaborate study of the ἅπαξ λεγόμενα in Plato, which will be carried to completion; another has been working at the literary use of the oath in the classic and in the Hellenistic period.

With special reference to the work of the seminary, the director lectured once a week during the term on the Symposion of Plato, and a short course of lectures on the Platonic canon, beginning January 15, was followed by weekly readings in the Republic. The History of Greek Philosophy was not touched in this department, as being elsewhere provided for in the lectures of Professor Hall. Professor Gildersleeve also delivered about forty lectures on the Syntax of the Hypotactic Sentence and conducted twenty-two exercises in translating Greek into English and English into Greek at dictation. He also held a short series of conferences in Greek Literature for undergraduates.

Dr. Bloomfield's courses are given under the head of Sanskrit (on p. 129.)

Dr. Herbert Weir Smyth gave a course of lectures, weekly through the year, on Dialectology, illustrated by Inscriptions.

The course was devoted to an investigation of the Doric and Aiolic Dialects. Stress was laid on original research into the phenomena of dialect-life and on the methods of acquiring facility in the explanation of forms varying from the Attic standard. Each member of the class presented the result of an investigation of one or more dialects, and interpreted inscriptions representing a cantonal idiom. Attention was directed chiefly to the dialects of Sparta, Heraclea, Crete, Melos, Thera, Corinth, Rhodes Delphi, Locris, Boeotia, Thessaly, and Lesbos. Portions of the text of Alcman, Timocreon, Stesichorus, Corinna, Alcaeus, Sappho, and Theocritus were discussed with a view to illustrate their dialect from the epigraphical monuments.

Additional courses were conducted by:

Professor C. D. Morris, in

Demosthenes, *de Corona, four times weekly, first half-year.*

Reading at sight.

Dr. Spieker, in

Xenophon's *Oeconomicus, four times weekly, first half-year.*

Homer, *Iliad*, IX, XI; Euripides, *Alcestis, four times weekly, second half-year.*

Mr. Christie, in

Sophocles, *Antigone, four times weekly, second half-year.*

Classes in Prose Composition were also conducted by each of the instructors in connection with the courses above named.

Students have read privately for examination the following books:

Aeschylus, *Prometheus*, (7).

Lysias, VII, IX, XII, XIII, XXIV, (4).

Plato, *Protagoras*, (7).

Herodotus, *Keep's Stories*, (4); *Merry's Selections*, (2).

Latin.

The Latin Seminary, under the direction of Dr. Warren, held two sessions a week throughout the year, the centre of work being the Roman Historians, especially Livy and Tacitus.

Select portions of Livy and Tacitus were made the subject of critical interpretation by the members of the Seminary, and papers were read by them embodying the results of special studies. Among the subjects thus treated may be noted: The use of *ob* and *propter* in the historians; the use of *frustra* and *nequiquam* in Livy; the use of the future active participle in Livy; chiasmus in Sallust; the constructions first found in Livy; the constructions first found in Sallust; the Carthaginian treaties; the authorship of the Bellum Hispaniense; also of the Eighth Book of the Bellum Gallicum, and the Bellum Alexandrinum; the style of the Bellum Africanum; the use in the Historians of *non modo—sed etiam, non solum . . sed etiam; non tantum* and similar expressions; the genuineness of the Lives ascribed to Nepos: Hannibal's passage of the Alps; Vergil's influence upon Tacitus.

In connection with the work of the Seminary, Dr. Warren gave a course of twenty lectures on the Roman historians from Fabius Pictor to Livy. In the first half of the year he conducted weekly meetings for the reading at sight of various Latin authors. In the second half of the year he conducted a weekly course of Practical Exercises in Latin, and gave weekly lectures on Latin Phonetics.

Additional courses have been conducted during the year by:

Dr. Warren in

Plautus, *Miles Gloriosus*, and Terence, *Andria, three times weekly, first half-year.*

Pliny, *Select Letters;* Juvenal, *Select Satires, three times weekly, second half-year.*

Reading at sight, *weekly throughout the year.*

Prof. Morris in

Cicero, *de Natura Deorum, bk. i;* Lucretius, *bks. i, iii, three times weekly, first half-year.*

Reading at sight, *weekly, first half-year.*

Dr. Spieker in

Livy, *bks. v, vi, four times weekly, first half year.*

Horace, *Select Odes, Satires, Epistles, four times weekly, second half-year.*

Mr. Moore in

Tacitus, *four times weekly, second half-year.*

Classes in Latin Prose Composition, meeting weekly, were also conducted by each of the instructors in connection with the courses above named.

Students have privately read for examination the following books:

Cæsar, *Bellum Civile*, (1).

Cicero, *pro Roscio Amerino, de Senectute, de Amicitia*, (12); *de Natura Deorum*, III, (4); *Select Letters*, (5).

Horace, *Epodes, Carmen Saeculare*, (8).

Lucretius, V, (4).

Plautus, *Mostellaria*, (5).

Tacitus, *Annals*, III, IV, (2), III, (1).

Terence, *Phormio*, (5).

Vergil, *Aeneid*, XII, (8).

Sanskrit and the Comparative Grammar of the Cognate Languages.

During the session the following courses were conducted by Dr. Bloomfield:

1. *Elementary Sanskrit.* The most essential elements of the grammar of the classical language were acquired in as short a time as possible, and then the students were brought face to face with the language, learning its structure and laws not in the abstract, but in its living body. This course served especially, as was found by practical experience, to furnish the students with a knowledge of grammatical analysis, clearer and more exact than that which they bring with them from other philological pursuits. This is due partly to the unrivalled transparence of the structure of the language, and partly to the tradition, which has kept alive a close bond between Sanskrit and Comparative and Historical Grammar. Five books of the *Nala* and several selections from the *Hitopadeça* were read and thoroughly analyzed.

2. A second class in Sanskrit was conducted through a rapid course of reading in the *Hitopadeça* and *Kathāsaritsāgara* during the first half-year. During the second half-year the same class was introduced into the study of the *Rig-Veda*, in which careful analysis of the forms and a constant comparison of the facts of the Vedic language with those of the classical Sanskrit were made most prominent.

3. The advanced work in Vedic Sanskrit was devoted to the study of the first book of the *Atharva-Veda*, under circumstances especially noteworthy. A considerable amount of manuscript material hitherto unpublished, which the lecturer had collected for his edition of the *Kāuçika-sūtra*, the ritualistic treatise of the *Atharva-Veda* (now going through the press), was brought to bear upon the exegesis of this book, not infrequently in such a manner as to yield results very different from those previously attained by other scholars (cf. Proceedings of the American Oriental Society for May, 1885, and 1886). The class was made acquainted with the advanced methods of textual and hermeneutical criticism, so as to be led to independent methods of dealing with Vedic texts.

4. A course in the *general principles of Comparative Philology* was carried on throughout the year. It was introduced by twelve lectures on the prominent questions of Indo-European philology (*phonetic law and analogy, the doctrine of agglutination, the questions attaching themselves to the relationships of languages*, etc.). During the remainder of the year Professor Whitney's "Language and the Study of Language" was made the basis of instruction, and the book was constantly supplemented by lectures, which aimed to advance the subjects treated in the book up to the present day.

5. A course in *Comparative Grammar of Greek.* This was introduced by a short course of lectures in which the relation of General Comparative Grammar to Greek Grammar was delineated; the reasons were pointed out, which make it incumbent upon students of the classical languages to become acquainted with the general results of Comparative Grammar. Most of the year was devoted to the detailed study of Greek Grammar upon the basis of Brugmann's Griechische Grammatik. This was carried on as in a seminary, each student taking his turn in handling the materials under discussion week by week. The compendious paragraphs of Brugmann were constantly supplemented by lectures.

Shemitic Languages.

The courses conducted by Professor Haupt during the past year principally aimed at giving the students of the two previous sessions a certain finish in their academic Shemitic studies. Special stress was laid upon reading select texts in the different Shemitic languages, the grammatical phenomena in the various idioms being constantly studied from the standpoint of Comparative Shemitic Philology. To Hebrew, Assyro-Babylonian, Sumero-Akkadian, Arabic, Ethiopic, and Biblical Aramean, Syriac was added. The centre of the work was the Assyro-Babylonian Cuneiform texts to which for some time ten hours weekly were devoted.

Professor Haupt conducted five advanced *Assyriological courses*: (1) Assyrian Historical texts, (2) Nimrod Epic, (3) Sumero-Akkadian, (4) Introduction to the Study of Babylonian Texts, (5) Assyriological exercises.

Of *historical Assyrian texts* there were read the Annals of Sennacherib (705–681 B. C.) on the hexagonal Taylor Clay Prism, the account of the king's building operations and of his first eight campaigns with the exception of the often-treated third campaign against King Hezekiah of Judah (701 B. C.).

Of the *Nimrod Epic* the whole sixth tablet was read in Haupt's edition (Leipzig, 1884).

In *Sumero-Akkadian* at first the grammatical texts in the second part of Haupt's *Keilschrifttexte* (Leipzig, 1881) were studied, after which the interpretation of select dialectical bilingual Penitential Psalms in the third part of Haupt's texts was proceeded with. Finally a number of hymns and incantations in the fourth volume of Sir Henry Rawlinson's *Cuneiform Inscriptions* (London, 1875) were read at sight.

In the *Babylonian* course selected inscriptions of Nebuchadnezzar, Neriglissar, and Nabonidus were read (I R., 51 and 52; 67 and 68) and also at sight some of the early inscriptions from Chaldea (I R., pl. 1–4).

In the *Assyriological Exercises* held during the month of January the whole cylinder inscription of Esarhaddon (681–668 B. C.) I R., pl. 45–47, was read.

In addition to these advanced courses a *beginners' course in Assyrian* was was given by the Fellow in Shemitic Languages, Mr. Cyrus Adler. The elements of the cuneiform writing and grammar were studied and then the great three column syllabary was read in the first part of Haupt's texts, together with occasional illustrations from historical texts, especially the Annals of Sardanapalus (668–626 B. C.).

To the study of *Hebrew* four hours a week through the year were devoted, two hours to a beginners' course, one hour to mastering the paradigms, &c., and finally one hour to a more advanced course. In the latter the history of Joseph as given in Genesis, XXXVII–XLV, was explained, and in the elementary course, Genesis XI. and following. The grammar used was Dr. Mitchell's translation of Gesenius-Kautzsch.

In the latter part of the session the elementary instruction in Hebrew was given by Mr. Huizinga, Fellow in Shemitic Languages, under the supervision of Professor Haupt.

In *Biblical Aramean*, a critical interpretation of the Book of Ezra was given, not only of the Aramean portions, Ezra IV, 8, VI, 18 and VII, 12–26, but also of the Hebrew chapters with constant reference to the Version of the LXX as well as the apocryphal book of Ezra (Ἔσδρας ά).

In *Ethiopic* the Sententiae e libro philosophorum excerptae in Dillmann's Chrestomathia Aethiopica were read and previous to this some of the Narratiunculae de Viris Sanctis, viz: (No. C.) De Dionysio M. Patriarcha Alexandriae, (No. D.) De Macario M. and (No. G.) De Tacla Haimanôt.

In *Arabic* there was read at first the second voyage of Sindbad the sailor from the Arabian Nights, and then some thirty selected extracts from the Arabian geographers Edrîsî, Abulfedâ, Ibn Baṭûṭah, Qazwînî, Ibn Ḥauqal, Ibn Sa'îd, el-Bekrî, &c., containing descriptions of the "country of the Franks," Brittany, Valencia, Genoa, Jaen, Rome, Sicily, Toulouse, Toledo, Constantinople, Lerida, Damietta, Morocco, Jaffa, Ḥamadân, Herât, Nisibis, Moṣul, Cyprus, Gaza, Ascalon, Tiberias, China, Sidon, Tyre, Shirâz, Sinjâr, Rhodes and Edessa. Cf. Nos. 316, 427–437, 441, 442, 444, 446, 447, 424–420, 414, 413, 411–407, 403, 399, 396 and 395 in the first volume of the Beyrut Arabic Chrestomathy Majânî-el-adab (Beyrut, 1883, Imprimerie Catholique).

In the *Syriac* course for beginners, the elementary difficulties having been overcome, the first chapter of Genesis as given in E. Nestle's Brevis Linguae Syriacae Grammatica &c., (Carolsruhae et Lipsiae, 1881) was thoroughly explained with constant reference to Nöldeke's Kurzgefasste Syrische Grammatik (Leipzig, 1880). At the same time there were from the first exercises in reading the Estrangelo writing. The pronunciation constantly followed, even in Western Syriac texts, was the Nestorian. After the principal grammatical phenomena in the first chapter of Genesis had been thoroughly mastered, select portions in Roediger's Chrestomathia Syriaca (Halis Saxonum, 1868) were read, chiefly extracts from the Syriac chronicles of Gregory Bar Ebhrâyâ: No. IV, De LXX Veteris Testamenti interpretibus; No. V, De epistularum commercio, quod Christus cum Abgaro rege fuisse traditur; No. VII, De bellorum cruciatorum initio; No. VIII, Salahuddinus Hierosolyma capit, Tyrum frusta oppugnat; No. XI, De Theophilo, Homeri interprete, and finally some parts of the Syriac Version (Peshita) of the New Testament, especially Matthew XXVI–XXVIII, as given in the beginning of Roediger's Chrestomathy; No. I, De passione, morte et resurrectione Jesu Christi.

German.

Dr. Wood conducted the following advanced courses:

German Seminary. The study of Low German formed the centre of the work of the Seminary for the year. During the first half-year the special subject was Old Saxon. Lectures were given on the grammar of the dialect, and on the development of forms into Middle Low German. The Hêliand was then read. During the second half-year the grammar of Low German was studied from Lübben and Nerger, and the following selections from the Middle Low German chrestomathy of the former were read: Nos. 2, 3, 6, 7, 11, 12, 13, 18, 19, 20, 24. *Twice weekly, through the year.*

Gothic. The selections in Braune's grammar were read, and the grammatical forms thoroughly learned. No systematic attempt was made to deduce forms in other dialects by the comparative method, but the simpler correspondences were pointed out and explained. *Twice weekly, first half-year.*

Old Norse. Brenner's Handbuch, but more especially Noreen's Altisländische Grammatik, were used for the grammar, and all the selections in Brenner were critically read. Rafn's Antiquitates Americanae was specially studied in connection with the sagas relating to Greenland and America. *Twice weekly, first half-year; weekly, second half-year.*

Middle High German. Parts of the first and third books of Parzival, and the whole of the fifth book were read and explained. *Weekly, second half-year.*

Lectures on Old Teutonic Life. The attempt was made in these weekly lectures extending through the year to present in a connected way the life and environment of the individual in early Teutonic times. About one-third of the lectures were devoted to Mythology, and the remainder to Law, Landholding, Domestic Life, Ships and the Sea, War and Weapons. As far as possible, the earliest literary monuments were made to contribute directly to the subject.

The following undergraduate courses were conducted by Drs. Goebel and Wood, and Mr. Hempl:

Major Course:

German Literature. Lectures. *Weekly.* Dr. Goebel.
Middle High German. *Weekly, first half-year.* Dr. Wood.
Selected Readings. Masius's *Lesebuch III. Weekly.* Dr. Goebel.
Goethe: *Hermann and Dorothea; Faust I. Twice weekly.* Dr. Goebel.
Prose Composition. *Weekly.* Mr. Hempl.
Exercises in German Style. *Monthly.* Dr. Goebel.

Minor Course:

Lessing: *Minna von Barnhelm.* (*Two sections*). *One, weekly, through year; one, twice weekly, second half-year.* Mr. Hempl.
Goethe: *Egmont. Twice weekly.* Dr. Goebel.
Historical Readings. *Twice weekly.* Dr. Goebel.
Scientific Readings. *First half-year, twice weekly; second half-year, two sections, each twice weekly.* Mr. Hempl.
Prose Composition. *First half-year, weekly; second half-year, two sections, each weekly.* Mr. Hempl.
Oral Practice. *Weekly.* Mr. Hempl.

A class in German conversation was conducted by Dr. Goebel daily, through the year.

Supplementary classes were conducted by Mr. Hempl, as follows:

Section 1. *Three times weekly.*
Section 2. *Daily, first half-year.*

Dr. Goebel also gave a series of twelve lectures, in German, on German Literature from Klopstock to the death of Goethe.

English.

Advanced courses were conducted as follows:

Dr. Wood met a class of advanced students twice weekly during the second half year, for the study of Béowulf. The apparatus for critical study was used, and all the more important variant readings were examined, but the special aim of the course was to translate the poem, nearly all the members of the class having construed the text in a previous course. Particular attention was paid to matters of expression, and to the vocabulary of English translation. The first 1,900 verses were translated.

In a course of lectures by Dr. Bright (twice weekly throughout the year), the principles of Early English Grammar were discussed from the earliest period to Chaucer. Anglo-Saxon was scientifically treated in its relation to the cognate Germanic dialects, and to its more remote Indogermanic antecedents; upon the basis thus secured the further development of the language towards the English of to-day was followed through the Earliest and Middle English periods in the manner of an expository study of Sievers' *Anglo-Saxon Grammar*, and ten Brink's *Chaucer's Sprache und Verskunst.* Parallel to this course, texts of the corresponding periods were interpreted (twice and three times weekly). For clearness of dialect on the one hand, and for the purpose of laying a basis for an historical study of English syntax, prose monuments of the West-Saxon dialects were selected. The entire *Orosius* of Alfred (Sweet's ed.) was read, then a large body of the *Homilies* of Aelfric and of Wulfstan, and finally a portion of the *Ancren Riwle.* As an introduction to the specific literary products of the Middle Period, and as more nearly bringing the language to that form from which Modern English ultimately proceeded, the romance of *Octavian* (Sarrazin's ed.) was also read.

All the advanced students of the department were organized into an English Seminary which was conducted by Dr. Bright. The student is trained to present written communications involving original research, the orderly presentation of theories and of problems in literature and in grammar, the employment of the principles of scientific and literary criticism, etc. Such papers were read and freely discussed at the regular (bi-weekly) meetings. Of topics so treated during the year may be named: The life and works of Congreve; The Apollonius saga in literature, and the authorship of *Pericles* (Shak.); Double Consonants in the Ormulum; The Anglo-Saxon Genesis and its relation to the Heliand; Certain of the Riddles of Cynewulf; On the development of the definite article in English; The Anglo-Saxon *Waldere* and the Saga in literature.

Additional courses, including the first and second years' courses for undergraduates, were conducted as follows:

The minor (first year's) course was directed by Drs. Browne and Bright.

In the first half-year the class studied with Dr. Browne, the writers of the Elizabethan period. Both the prose-writers and poets of that period were examined, but especial attention was given to the development of the drama. The Shakespearian drama was carefully studied in *King Lear;* while the drama preceding Shakespeare was represented by Sackville's *Gorboduc* and Marlowe's *Edward II,* and that immediately following by Massinger's *New Way to Pay Old Debts.*

In the second half-year the literature of the fourteenth century was taken up. The texts studied were Chaucer's *Nonne Prestes Tale* and *Prioresses Tale* (Morris and Skeat) and portions of *Piers the Plowman* (Skeat). The literature of the period was further illustrated by readings from Wyclif, Maundevile, and *William of Palerne.* Dr. Browne also lectured once weekly to this class on the literature of the eighteenth century.

For those beginning the study of Anglo Saxon, a class was conducted, by Dr. Bright, in Sweet's *Anglo-Saxon Reader.* The beginners in Middle English formed a class, conducted by Mr. Egge, in Morris's *Specimens,* I, and in *The Tale of Gamelyn* (Skeat's Edition).

The elements of Phonetics were taught (once weekly, first half year) by Dr. Bright. The fundamental principles of the science were inculcated with the help of the best modern authorities, and by practical application to the students' vernacular, and to French and German. Sweet's *Handbook* was used.

The major, or second year's course, was conducted by Drs. Bright and Browne.

The study of Early English Literature (Dr. Bright, once weekly throughout the year) was carried on with the use of ten Brink's *Manual.* The text was liberally supplemented by lectures, and by readings from the literature itself.

A portion of the class met Dr. Browne once weekly to study the literature of the nineteenth century.

The English work in the P. H. E. course (required of all undergraduates) covered the whole field of English Literature from the earliest period to the opening of the present century. The historical development of the literature, as coördinated with that of the people, was steadily kept in view, and its continuity insisted on. Chaucer's *Prologue* and *Knightes Tale*, Shakespeare's *Richard III*, and part of Milton's *Paradise Lost* were read aloud by the class, under the guidance of the instructor.

Essays by the undergraduates were submitted to the instructor, who, in his comments, did not merely correct errors, but aimed at inculcating the principles of good writing.

Romance Languages.

Advanced Courses were conducted as follows:

The Romance Seminary, under the direction of Mr. Elliott. *Two hours a week through the year.*

This work was confined to the domain of the Norman Dialect. For the first term, it centred in the *Vie de Saint Alexis*, for which the MS. fac-simile was used. For the second term, extracts from the *Roman de Rou* were examined with the view of continuing the student on the same line of study, and, finally, a brief introduction was given to the language of Chardry's *Josaphaz* (Koch's edition).

For the first of these texts, the mixed dialect character was especially considered and, for all of them, phonological and morphological relations to the Classic and Low Latin, to the oldest products of the other Romance Languages, to the later Old French documents and to the modern language, formed the bulk of material with which the Seminary was occupied. This course was followed by the most advanced students only. In addition to it, a pro-seminary meeting, of two hours, was held once a fortnight, in which all special students of this department took part. The exercises here consisted in the reading of original papers, bearing, as it happened, in great measure upon phonetics and lingnistic pedagogical subjects, of extracts of important articles in Romance journals, of general reports on the journals themselves, of reports on recent publications received and on any suggestive correspondence, of a professional nature, that might be presented. By this means, students in the early part of their university studies have the benefit of direct and active association with their more experienced co-workers in the field.

Introduction to Old French Philology. This course is intended for first year students and regularly follows the series of lectures on Modern French Phonetics, as given below. A few pages of *Aucassin et Nicolète* (Suchier's edition) were critically examined with special reference to the phonology and morphology of the language. For the former, the constant application of the principles of French phonology was required, while, for the latter, the student was thoroughly drilled in the grammar of the Old French as compared with the Latin on the one hand, and with the Modern French on the other. The leading characteristic forms of the dialect here represented were contrasted with corresponding ones in the Isle-de-France species. *Weekly, second half-year.*

Lectures:—(*a*) On the Langue d'Oïl Dialects. The object of this course was to give the leading characteristics of the chief dialect groups (Wallonian, Picard, Norman, Maine, Paris, Lorraine, Burgundian, Poitevin) that constitute the North French. The system followed in carrying out this idea was, first, to give a series of eight lectures on the most striking peculiarities and geographical distribution of these dialects as a group, then, to follow these with special lectures on the phonetics and morphology of each individual idiom and, as soon as a given dialect was thus represented, select texts were translated and their dialectic peculiarities pointed out by the student himself. *Weekly.*

(*b*) On the North Italian Dialects. This course was given to third year students and the same plan was followed as with first year students in (*a*). The idioms covered were: Venetian, Milanese, Piemontese, Bolognese, Genoese, and one South Italian dialect, the Neapolitan. *Weekly.*

(*c*) Modern French Phonetics. This course was intended for first year students who wished to become specialists in the Romance Languages. An introduction was given to the different systems of phonetic representation as proposed for French in particular, and, after a survey of the general principles underlying sound and sign change in this language, the various phonetic categories were taken up and severally dealt with in their historic development out of the Classic and the Low Latin products. The student was held here to modern forms exclusively and taught to make use of scientific methods. *Weekly, first half-year.*

(*d*) Comparative Romance Morphology. This course, arranged for second year students, is intended to place them abreast of the present movement in Romance Morphological Science. To this end, as a convenient and accessible point of departure, Diez' *Grammatik der Romanischen Sprachen* was taken and attention given particularly to the advancement of this science since his time. *Weekly.*

(*e*) Old French Syntax. An attempt was made here to present the more important features of word-arrangement for the earliest prose and for the thirteenth century poetry of Old French, in their agreement with the Latin on the one hand and variation from modern usage on the other.

(*f*) The History of Romance Studies in Europe. The history of the various theories, from the fifteenth century down, with reference to the origin and growth of the Romance Languages was succinctly given, the writings of individual scholars that have worked in the field were characterized, and the chief treatises, monographs, and articles of those now engaged in Romance studies, their official standing, the universities with which they are connected and their special lines of work were noted, and critical remarks made on the general bearing and worth of their productions for the subjects which they treat. This course was intended to put the student abreast of the present scientific production in this field. *Weekly.*

In addition to the above, special courses in Italian, Spanish, Portuguese, and Old Provençal were conducted for graduate students by Dr. Todd:—The class in Italian have read numerous selections from the *Italian Principia*, Part II; Massimo d'Azeglio's *Niccolò de Lapi* (five chapters); Macchiavelli's *Principe*; and twenty-nine cantos of Dante's *Purgatorio*. Exercises in grammar were given twice weekly in connection with the above through the first half-year.

The class in Spanish have read one hundred and forty pages of Knapp's Spanish Readings; *El Barómetro* (comedia); and eleven chapters of *Don Quijote*. Exercises in grammar were given twice weekly.

In Portuguese the class have read five chapters of Herculano's *Eurico* and two cantos of Camoens' *Lusiads*. The course was begun with a brief study of the grammar.

In Old Provençal were studied the *Poème sur Boèce*; selections from *Girart de Rossilho*, from the poetry of Marcabrun, Bernart de Ventadorn, Peire d'Alvernhe and Arnaut de Maroill; and nearly all the prose of Bartsch's Chrestomathie.

A short course was also given in Cionca's *Practische Grammatik der romänischen Sprache* (Wallachian).

The Undergraduate Courses were as follows:

The students of the French Major Course read with Dr. Todd:

In Bartsch's Chrestomathie, the selections from *Les plus anciens monuments, St. Alexis, Chanson de Roland, Amis et Amiles, Mystère d'Adam, Roman de Rou, Contes del Graal, Roman de Renart, Aucassin et Nicolète, Roman de la Rose*, and the leading prose writers of the XIII, XIV, and XV centuries. *Twice weekly, first half-year.*

In Darmesteter and Hatzfeld's *Morceaux choisis des principaux écrivains du XVIe siècle*, selections from all the leading writers. *Twice weekly, second half-year.*

In the French of the XVII century the class have read Corneille's *Cinna*; Racine's *Andromaque*; and Moliere's *Femmes Savants*. *Weekly.*

The study of French style has been carried on under Mr. Fontaine, with the translation of numerous extracts from Gasc's French Prose Composition. *Weekly.*

Lectures on Old and Middle French literature were given weekly through the year by Dr. Todd.

The students of the French Minor Course read with Dr. Todd: *Ourika* by Madame de Duras, *La Dot de Suzette* by Fiévée, *Le Siège de Berlin, L'Enfant espion* and *Les Emotions d'un Perdreau rouge* by Alphonse

Dandet, *Les Vices du Capitaine* by François Coppée, *La Saint-Nicolas* by André Theuriet, *La Fille du Chanoine* by Edmond About, *Le Chevalier double* by Théophile Gautier, *Croisilles* by Alfred de Musset, and *Hernani* by Victor Hugo; in connection with the above, twenty minutes' talks on Modern French Literature have been given, on the basis of Bougeault's *Précis de la Littérature Française.*

With Mr. Bowen the class have read the greater part of Crane and Brun's *Tableaux de la Révolution française* and Luquiens' Course in Scientific French, and in connection with this studied 150 pp. of Breymann's French Grammar; with Mr. Fontaine they studied and prepared written exercises on the whole of Part I. and a portion of Part II. in Chardenal's Exercises for Advanced Pupils.

Mr. Fontaine met the students three times weekly for French conversation, with systematic instruction and drill in pronunciation.

Courses of lectures in French Literature were given (in French) by M. Rabillon.

The JOHNS HOPKINS PHILOLOGICAL ASSOCIATION has met monthly as heretofore. Papers have been read during the session by:

C. ADLER.—On the Hebrew words in the Codex Sangallensis 912.

M. BLOOMFIELD.—Contributions to the Exegesis of the First Book of the Atharva-Veda.

M. BLOOMFIELD and E. H. SPIEKER.—The Old-Indian Sibilants: 1. Preliminary remarks on the correlation of *m* and *v* in the Vedas; 2. Introduction to the study of the sibilants and the influence of sibilants upon one another.

J. W. BRIGHT.—On silent *t* in Modern English.

A. E. EGOE.—On some points of Intonation and Quantity in English, Norse, and German.

A. M. ELLIOTT.—French Speech-mixture in Canada: External Influences.

M. D. LEARNED.—The Origin and Settlement of the Pennsylvania Germans.

C. W. E. MILLER.—On the Participle in Pindar.

C. D. MORRIS.—On Krüger's Chronology of the Pentecontaëtia of Thucydides.

H. W. SMYTH.—On the Reduction of *ει* to *ῑ* in Homer; on the Dialects of North Greece.

E. H. SPIEKER.—Notes on Isaeus.

H. WOOD.—On Gilic as Adverb in Old Saxon and related forms, and on the Relation of the forms Grornôn and Gornôn in Old Saxon.

J. H. WRIGHT.—On four unpublished White Lecythi from Athens.

The sixth volume of the AMERICAN JOURNAL OF PHILOLOGY was completed during the year and the first number of the seventh volume issued. An edition of 250 copies of a Syriac MS. with the Antilegomena Epistles was reproduced in phototype and published by the Publication Agency in April, 1886.

Lectures on Archæology were given by Dr. W. Hayes Ward, Dr. A. L. Frothingham, and Professor F. W. Putnam. A course of eighteen lectures on the History of the Printed New Testament and of two lectures on the Syrian Antilegomena Epistles was given by Dr. Isaac H. Hall.

HISTORICAL AND POLITICAL SCIENCE.

PROGRAMME FOR 1886-87.

I. Graduate and Advanced Courses.

1. Seminary of American History and Economics.

Weekly meetings, through the year, with DR. H. B. ADAMS.

Only graduate students connected with the University are received as members of the Seminary. The work of this co-operative organization of teachers and instructors in the department of History and Politics is chiefly devoted to original research in the fields of American Institutions and American Economics. The exercises of the Seminary, which occupy two hours each week, consist of oral and written reports of progress, discussions of papers, and reviews of current historical and economic literature.

During the coming year Seminary researches will be more especially in the fields of American Institutional, Administrative, and Economic History. The completed scientific work of members of the Seminary finds its way into the University Studies in Historical and Political Science, or into magazines. Three books will be published during the year 1886–87 by members of the Seminary: (1) History of Economic Thought in the United States, by Dr. Ely and Messrs. Davis R. Dewey and Woodrow Wilson; (2) Co-operation in America, in preparation by Dr. Ely, Dr. Shaw, and Messrs. Dewey, Levermore, Randall, and Warner; and (3) The Republic of New Haven and its Town Colonies, by Mr. Charles H. Levermore.

2. History of Politics.

Two hours weekly, through the year, with DR. H. B. ADAMS.

This course of instruction in institutional history and in the theory of politics is designed to occupy three years of class-work, two hours a week. It is intended that each year there shall be two courses of lectures, one representing some field of ancient politics, and another some field of modern politics.

The first year, one part of the work is devoted to theories of ancient society and to the early history of institutions, to Greek political philosophy and Greek institutions. The second part of the year's work is an exposition of Bluntschli's Theory of the Modern State, together with lectures on the Rise of Prussia and its Relation to Modern German Politics. The second year comprises a study of Cicero's Republic, with lectures on Roman institutions of government, municipal and provincial, as representative of ancient politics, and of French political philosophy and of French revolutions as illustrative of modern politics. The third year opens with a study of Teutonic institutions, as described by Tacitus and as revealed in early codes of law. The course continues with the development of those institutions into the English and American constitutional forms of government. During the coming year, the graduate work will be in the Germanic, especially in the Anglo-American field. The class is examined orally upon the lectures, from day to day; and, once a month, a written examination is held upon assigned periods of political history, read privately, so that the lectures on institutional history may be properly supplemented.

3. Elements of Historical Criticism.

Once weekly, through the year, by DR. J. F. JAMESON.

The object of this course will be to expose systematically and with due illustration the elementary principles of modern historical criticism, in order to afford the graduate students of history a fuller knowledge of the best methods now employed in critical investigation. It is intended that the instruction given in lectures shall be accompanied by practical exercises on the part of the class.

4. Historical Writing in America.

DR. J. F. JAMESON will give a course of four public lectures in Hopkins Hall, on the history of historical writing in America from the period of colonization to the present time.

5. Finance and Taxation.

Three hours weekly, through the year, with DR. R. T. ELY.

This course for graduates, three times weekly, second year, is adapted to students of law and to others who have followed the preliminary instruction in Political Economy. It comprises lectures on the general principles and history of money, banking and finance. Special attention will be given during the coming year to the subject of taxation in the cities and States of the American Union, and the course will conclude with a sketch of the financial history of the United States. It includes a series of class lectures by the students on the various topics of the course, and occasionally debates are encouraged on such subjects as monometallism and bimetallism.

6. Studies in Administration.

Weekly, through the year, with DR. ELY.

A general view of French administration will be treated and special attention will be given to charities and sanitary administration.

7. Roman Law.

Two hours weekly through the year, with MR. G. H. EMMOTT.

The topics treated of will be:

The history and sources of the Roman law; the law of the family; the law of things; the law of wills; the law of contract; forms of contract; the law of procedure. The course will be taught in part by lectures, and, in addition to the authorities named below, the results of the investigations of Austin, Clark, Markby, Holland, and Maine, as well as of the most recent French and German scholarship will be placed before the class. Subjects will be given out from time to time upon which essays and oral reports will be expected.

Books of Reference.—Abdy and Walker's or Poste's Institutes of Gaius, Moyle's Institutes of Justinian, Hunter's Roman Law, Ortolan's Explication Historique des Instituts.

Note:—Historical Courses in French, German, and Italian. Graduate students are required to obtain a sufficient knowledge of the modern languages to read at least French and German at sight. To this end special advantages are offered by the courses of historical readings in the Romance and German departments (French and Italian each for one hour, and German for two hours a week through the year).

II. Undergraduate Courses.

History.

Introductory.

1. History and Physical Geography.

Three hours weekly, through the year, with DR. H. B. ADAMS *and* DR. J. F. JAMESON.

This is part of the so-called "P. H. E." course, which includes English with Physical Geography and History, and is required of all undergraduates during the first year of their college work. It is practically a continuation of the English studies required for matriculation, but it lays a broader and deeper basis. Fifteen introductory lectures are given by Dr. H. B. Adams upon the Origin of Civilization, Egypt, Mesopotamia, India, Palestine, and Phoenicia, with oral and written examinations upon the same, and upon Keary's Dawn of History. Physical Geography is taught by Dr. J. F. Jameson who gives fifteen class lectures on its relations to History, upon which the students are examined. Students who have presented classical history for matriculation may take a modern course of two hours a week through the year in European history; but those who present the modern course for matriculation are required to pursue classical history (Fyffe's Greece and Leighton's Rome) two hours a week throughout the year, with Dr. Jameson. For the instruction given in English literature and English prose style, see English courses.

First Year.

2. Classical Course in History.

Five hours weekly, through the year, with DR. WARREN, DR. SPIEKER, *and* DR. JAMESON.

Students who elect History and Politics for their principal subjects are required to lay classical foundations for their future work by attending four exercises weekly in the classical department, during the first year of their college course, for the reading of Livy and Tacitus in the original texts. A fifth hour is devoted to examinations by Dr. Jameson upon Herodotus and Thucydides, which are read privately by the class in English translations.

This course is quite distinct from the text-book course with Dr. Jameson in Greek and Roman History (see note under course 1) although parallel with it. An acquaintance with the sources of classical history, Greek politics, and the Latin language is regarded as essential for all students of ecclesiastical and mediæval history, as well as of Roman law and institutions.

Second Year.

3. Modern Course in History.

Five hours weekly, through the year, with DR. H. B. ADAMS *and* DR. J. F. JAMESON.

This forms the second year's course in History for matriculated students and cannot be taken until after the "P. H. E." and the Classical course in History have been completed, except in the case of special students of marked ability. Two hours a week through the year are devoted to the History of the Church in its relations to the Roman Empire, the Germanic kingdoms and the German Empire, to the study of ecclesiastical and political institutions, the rise of the Italian Republics, the Italian Renaissance and its influence upon the German Reformation. Three hours a week throughout the year are given to a course in the parallel study of the mediæval and modern history of England and France, with Dr. J. F. Jameson. Lectures will be given, and essays and reports required.

Besides class lectures, upon which the students are examined, the following text-books are employed: Bryce's Holy Roman Empire, Green's Short History of the English People, and the Student's France. Students are also examined upon select chapters of one of the following courses of private reading: (1) Milman's Latin Christianity, (2) Gibbon's Decline and Fall of the Roman Empire, (3) Symonds' Renaissance in Italy, (4) Motley's Rise of the Dutch Republic and History of the United Netherlands. Five historical essays and numerous oral reports upon assigned topics are also required before the completion of the historical course.

Political Science.

4. Elements of Political Economy.

Three hours weekly through the year, with DR. R. T. ELY.

This subject is taken up in the second year of the college course parallel with the course in European History. The instruction consists of text-book exercises (John Stuart Mill and Walker, with occasional references to other works).

The members of the class are examined on assigned lessons and difficult points are carefully explained by the instructor. Essays and discussions by the class upon topics suggested by these exercises constitute an important feature of the course. The aim is to familiarize the students with the general principles of economics and with their application. Reference-lists are given to the members of the class by the instructor, to aid them in the preparation of essays.

5. Modern Financial and Social Topics.

Two hours a week through the second year, with DR. ELY.

This class-work is taken conjointly with the course described above. It consists of familiar talks by Dr. Ely on questions of the day, which are treated historically and critically.

The course embraces also exercises and problems in economics, which are designed to teach the members of the class to apply general principles to practical affairs and to train them in habits of correct reasoning. The general aim of both courses is to familiarize the students with the historical development of modern social theories and the main results of economic research, and to enable them to discuss economic affairs intelligently.

6. Elements of International Law.

Two hours a week, through the third year, with DR. H. B. ADAMS.

This course is taken conjointly with the class course, three hours a week, in the English and American Constitutions. Introductory lectures are given on the History of International Law and Politics, after which, Bluntschli's *Moderne Voelkerrecht der Civilisirten Staten* is expounded.

The study, as here pursued, requires a reading acquaintance with French and German, which languages must be acquired before the end of the second year of the college course. Members of the class are required to report on assigned topics of diplomatic history and contemporary international questions.

7. The English and American Constitutions.

Three times weekly, through the year, with Dr. Jameson.

A course in the study of the development and present forms of constitutional government in England and the United States.

WORK OF THE PAST YEAR, 1885-86.

I. Seminary Work.

The Seminary of History and Politics, under the guidance of Dr. H. B. Adams, with twenty regular members (three instructors and seventeen graduate students), has met Friday evenings for a session of two hours, throughout the academic year. The work of the Seminary, as in former years, has been chiefly in the field of American Governmental Institutions and of Historical Economics. Special attention has been given to colonial beginnings, municipal development, agrarian history, the railway problem, the origin and growth of historical and political studies in this country.

Practical inquiries into methods of federal administration have been encouraged, particularly in regard to the Land Office, the Bureau of Labor, the Bureau of Education, the Office of the President, and of the Civil Service Commission. Valuable aid has been given by individual representatives of these federal institutions, notably by Hon. Dorman B. Eaton.

The following contributions to the Seminary Proceedings are soon to be published: (1) The Study of History in American Colleges and Universities, historically considered,—a series of papers by Dr. H. B. Adams, to be published, first, in "*Education*" (May, June, July, etc., 1886) and, second, by the Bureau of Education. (2) A series of three articles on American Railways and one on American Socialism, by Dr. R. T. Ely, the former to be published in Harper's Magazine, July, August, and September, 1886, and the latter in the North American Review. (3) Willem Usselinx, Founder of the Dutch and Swedish West India Companies, a monograph based upon new materials from foreign archives, by Dr. J. F. Jameson, to be published by the American Historical Association. (4) American Political Economy before the time of Henry C. Carey, by Davis R. Dewey, Fellow of History, a contribution to the joint History of Economic Thought in the United States by Messrs. Ely, Wilson, and Dewey. (5) The Republic of New Haven (a History of Municipal Evolution) by Charles H. Levermore, Fellow in History, 1885–6. (6) History of the Land Question in the United States, or the Formation and Administration of the Public Domain (to be published in the *Studies*, July, August, and September, 1886), by Shosuke Sato, Fellow by Courtesy, J. H. U., and a recent appointee in the colonial department of Japan.

II. Publications.

The publication of the Johns Hopkins University Studies in Historical and Political Science began in 1882, under the editorial direction of Dr. H. B. Adams. This monthly series of monographs, devoted to American Institutions of Government and Historical Economics, is the main means of publication for seminary work, although but one of the works above mentioned will take this channel. Three volumes of the *Studies* have hitherto been published, averaging about 600 pages each. The fourth volume is half completed.

The first volume is devoted to "Local Institutions." The second volume includes "Institutions and Economics." The third is entitled "Maryland, Virginia, and Washington." It comprises a new and revised edition of H. B. Adams' study of "Maryland's Influence upon Land Cessions to the United States," which was introductory to more recent seminary studies in the agrarian history of the United States; the Local Institutions of Maryland and Virginia, by Dr. L. W. Wilhelm, sometime Fellow of History, and Edward Ingle, A. B., embracing studies of colonial land systems, hundreds, parishes, counties, towns; Influence of the Proprietors in founding the State of New Jersey, by Professor Austin Scott, formerly of this University; American Constitutions, by Horace Davis, A. B. Harvard, with comparisons between State and federal government; and the Origin and Administration of the City of Washington, by John Addison Porter, A. B. Yale.

III. Class Courses.

Dr. H. B. Adams has been in charge of the department of Historical and Political Science and has conducted the following courses:

1. The Seminary, two hours a week, as above described.

2. A class of eighteen graduate students, two hours a week throughout the year,—the first half-year, in the History of Roman Politics, and the second half-year, in the History of French Politics.

This was a course of class-lectures, with a brief oral examination before each lecture upon the substance of the preceding lecture. The course began with an account of the renaissance of Roman History and Roman Politics since Niebuhr's lectures in Berlin, 1811, and the discovery of Cicero's Republic in 1822. The lecturer reviewed the institutions of the royal period as described by Livy, and then treated, in the light of modern authorities, the methods of Roman government by the senate, popular assemblies, and magistrates throughout the republican period, showing the degeneration of politics under the empire. Particular attention was given to the agrarian laws; the colonial, municipal, and provincial systems of Rome; and to the extension of Roman citizenship. The course on French Politics dealt chiefly with the rise of absolute monarchy, the reproduction of Roman ideas of sovereignty and administration, the decay of French nobility, and the rise of the Third Estate.

3. Monthly written examinations of the graduate students upon stated periods of general history, beginning with that of Greece.

This exercise has been found exceedingly profitable and highly satisfactory to the graduate students, who have thus been required to read, or review, general history in a systematic way, without interfering unduly with more special work.

4. A class of four graduate and thirteen undergraduate students two hours a week throughout the year; the first half-year, in the History of the Church in its relations to the Roman and German Empires; second half-year, in the Rise of the Italian Republics, the Renaissance, and the Beginnings of the Reformation.

This class forms one portion of the Major History, or second year's course (the first being in classical historians,—Herodotus, Thucydides, Livy, and Tacitus). The other portion is Dr. Jameson's course in French and English History, described under the head of his work. Dr. Adams' class work has been, first, by lectures; second, by oral examinations upon the lectures and assigned topics in the Student's Ecclesiastical History and in Bryce's Holy Roman Empire; and, third, by student-essays upon appointed themes, reported orally in class, with a black-board analysis which aided students to take notes. Written examinations upon every portion of the work were required.

5. A class of ten undergraduate and five graduate students in the History and Elements of International Law, two hours a week throughout the year.

This work is associated with that of Dr. Jameson in the English and American Constitutions. It is one factor in the Political Science Major (second year, the first year of Political Science being Political Economy). Dr. Adams gave a course of lectures on the History of intertribal, intermunicipal, and international relations, introductory to the study of the elements of international law, which was pursued by means of the text-book of Dr. Woolsey. The class made a special study of the history of treatises. Various essays on the Diplomatic History of

the United States were reported orally, after the manner described under course 4.

6. A class of forty-two undergraduates in Ante-classic History, one hour a week, first half-year.

The idea of this course is to give an historical introduction to the so-called "P. H. E." course, which consists of Physical Geography, Classical or Modern European History, and English. The introductory lectures by Dr. Adams related to the early history of society, the more interesting aspects of such ancient peoples as the Egyptians, the Babylonians, the Assyrians, and other oriental nations. The lectures were illustrated by objects from the historical museum, *e. g.* by the Ellinger collection of stone and bronze relics and by the Cohen collection of Egyptian antiquities. One lecture was given to the class by Mr. Adler, Fellow in the Shemitic Languages, on ancient Babylonia.

Dr. R. T. Ely has given the following courses:

1. Lectures in Advanced Political Economy, to graduate students, two hours weekly, first half-year, and three hours weekly throughout the second half-year.

This course opened with a discussion of the fundamental principles of political economy, including the logical method of the sciences. The nature and proper application of the inductive, deductive, and statistical methods were treated at length. This was followed by a brief review of the history of political economy. The course closed with lectures on the historical development of trades and manufactures. Members of the class prepared and presented student-lectures. Among the subjects treated were, Luxury, Economic Laws, Ethics and Economics, the State and Economics, and Charles Périn.

2. Comparative Studies in Administration, once weekly through the year.

This course consisted of lectures on the administration of the interior in England, France, and Prussia, and included a treatment of administrative courts.

3. A course of class instruction to undergraduate students in the Elements of Political Economy and in Modern Social Problems, five hours a week through the year.

The instruction was based on the text-books of John Stuart Mill and Francis A. Walker, with references to works by Cossa, Laveleye, and others. Occasional written exercises, in addition to oral and written examinations, formed a feature of the course. Two essays upon assigned topics were required from each member of the class. Among the subjects of essays were the following: Banking in England, the National Banking System in the United States, the Wage Fund Theory, Paper Money, Robert Owen, the Sub-Treasury System, Wages.

Dr. J. F. Jameson has conducted class courses as follows:

1. History of Greece, of Rome, and of the Roman Empire down to the fifth century A. D., twice weekly throughout the year.

Fyffe's Greece and Leighton's Rome were used, and lectures were given. This work formed part of the "P. H. E." course.

2. Study of the Relations of Physical Geography to History, once weekly during the second half-year.

This also formed an element of the "P. H. E." course.

3. Thucydides in English translation, once a week during the second half-year, in continuation of the work done in Herodotus with Professor C. D. Morris.

4. History of England and France, three times weekly throughout the year.

Green's Short History of the English People and the Student's History of France were used as text books, and supplemented by informal lectures. Essays and reports were required. This course, with that of Dr. Adams' on the Church, the Empire, and the Renaissance, constituted the second year of history.

5. The Constitutions of England and the United States, three times weekly through the year.

This formed, in connection with Dr. Adams' course in international law, the second year of political science. During the first half-year Walpole's Electorate and Legislature, Traill's Central Government, and Bagehot's English Constitution were used as text-books, and lectures were given. During the second half-year the Constitution of 1789, the present forms of government, and the course of constitutional development in the intervening period were studied without text-book.

Mr. W. P. Holcomb gave a course of class instruction, two hours a week throughout the year, in the Outlines of European History.

This was in the "P. H. E." course and was offered as a substitute for Greek and Roman History to those who presented Classical History for matriculation.

PSYCHOLOGY AND PEDAGOGICS; LOGIC AND ETHICS.

PROGRAMMES FOR 1886-87.

Psychology and Pedagogics.

PROFESSOR G. STANLEY HALL will conduct the following courses for advanced students:—

1. General Systematic Psychology. *Semi-weekly lectures and weekly conferences through the year.*

The lectures will begin with a few special problems in physiological optics to make connexion with the course of the preceding year, which was entirely devoted to the senses. The work of the coming year includes such topics as compound reflex action and instinct in animals, memory, association of ideas, attention, volition, and aesthetic and general feeling and emotion. The contributions of psycho and neuro-pathology to the understanding of normal function and histology of the cerebro-spinal nervous system will receive special attention. The psychology and pathology of speech and writing will be illustrated. Much attention will also be given to the psychical parts of anthropology and its present problems, methods, and results, including recent studies on the evolution of the psychic faculties in children and the race. This will introduce the psychology of national and other comprehensive systems of opinion and thought and, in short, the endeavor will be to give as briefly as possible, with the many demonstrations, experiments, and illustrations involved in parts of the course, a brief survey of the vast field of modern scientific psychology, which, while leaving out nothing essential in the old philosophical disciplines, vivifies them by bringing to them a new standpoint, a new method, and a vast body of pregnant and experimentally demonstrated facts.

This course is intended for special students of psychology, and they should have at least such an acquaintance with elementary Logic, Ethics, and Psychology, as may be acquired in the undergraduate courses of this and other collegiate institutions. Students of biology and of medicine who desire to study the psychic functions of animals, and especially of man, may attend this course. A limited number of qualified students will be encouraged to investigate certain themes in the rooms devoted to psycho-physical research, where suitable instruments are provided. The apparatus for the study of dermal sensations and for fine chronographic work is quite complete. Arrangements have been made by which the results of investigations may be published in *Mind*.

2. Pedagogics. *A weekly lecture and conference through the year.*

This course embraces two years' work. That of the past year on the history of educational institutions and theories is the first year of this course. The second, which is to begin next year, is on select chapters and problems in education, and will comprise a survey of various grades and topics of teaching, special institutions, etc., including the present questions pertaining to industrial, moral, professional, female, gymnasial education &c. This course, and especially next year's work, is designed to be helpful to all who are fitting themselves to teach specialties in higher educational institutions, and if found feasible a practical seminary will be conducted.

3. History of Philosophy. Continuing from the history of Greek philosophy given during the past year, the next year's work will be devoted both in seminary and lectures to the general field of the history of modern philosophy. This course is intended not only for special students of philosophy, but also for students of literature, science, and especially history.

Logic and Ethics.

Preliminary Announcement.

The courses in Logic and Ethics will be given by MR. G. H. EMMOTT, Associate Professor (elect) of Logic and Ethics (A. B. and B. L., University of Cambridge (Eng.), 1879, and A. M., 1882, and recently Associate and Lecturer in Owens College, Manchester). Mr. Emmott will reach Baltimore before the opening of the academic year, when more detailed announcements will be made.

Undergraduate courses will be given in:

1. Deductive and Inductive Logic.

(*a*) Province and Definition of Logic; (*b*) The Terms of Thought: Notion, Judgment, Reasoning; (*c*) Methods of Scientific Investigation and Proof; (*d*) Fallacies. The work in this class will consist of lectures, recitations, themes, epitomes, etc.

Text-Books: Thomson's Outlines of the Laws of Thought, Fowler's Elements of Inductive Logic, with selected passages from the works of Mill, Jevons, and other recent writers.

2. Ethics.

In this class the fundamental problems of Moral Philosophy, and their application to the guidance of conduct, will be considered with special reference to the Christian theory of morals. The subject will be taught in part by lectures and, whilst keeping to a scientific basis, the aim throughout will be to make the instruction of a directly practical nature.

Books of Reference: Porter's Elements of Moral Science, Martensen's Christian Ethics, Maurice's Social Morality, Wuttke's History of Christian Ethics. Selected passages from other standard writers will also be recommended, from time to time.

Mr. Emmott will also give a course in Roman Law (see announcement under History and Political Science, on p. 133.)

WORK OF THE PAST YEAR, 1885-86.

Professor Hall lectured once weekly the first half-year and twice weekly through the last half-year on the senses, beginning with touch. Demonstration exercises were held, conducted by Dr. Donaldson and others in connection with this work.

Three advanced students were engaged in original psycho-physic research, the results of which will be made public in due time.

A weekly conference in psycho-physics was held on morbid psychology, and on the finer anatomy of the brain and spinal cord.

Dr. H. H. Donaldson lectured weekly on the relation between psychology and general biology, and conducted, twice weekly, demonstrations in the practical histology of the central nervous system.

Professor Hall lectured once weekly through the year on the history of education, beginning with Greece, and covering topics of which a classified, descriptive bibliography now in press will serve as a syllabus.

A course of educational lectures by various members of the Academic Faculty was given Saturday mornings to graduate students and was largely attended.

Professor Hall lectured weekly through the year on the history of Greek philosophy and especially psychology.

In connection with this course a conference was held weekly for the more careful study and discussion of selected themes in Greek Philosophy.

The daily work of the undergraduate courses, designated as the L. E. P. course, was conducted as follows:

Professor Morris taught Logic, both inductive and deductive, during the first term. Professor Hall taught Ethics with Mayor's Greek Philosophy, and Psychology with Ladd's translation of Lotze's dictation as a basis during the remainder of the year.

THE JOHNS HOPKINS UNIVERSITY CIRCULARS are published at convenient intervals during the academic year for the purpose of communicating intelligence to the various members of the University in respect to work which is here in progress, as well as for the purpose of promulgating official announcements from the governing and teaching bodies. During the current academic year, ten circulars will be issued in successive months, to be followed at the close of the year by an index.

Although these circulars are designed for the members of the University, they have frequently been called for by institutions and libraries at a distance, and also by individuals who are interested in the literary and scientific activity of this University. Subscriptions and exchanges are therefore received.

TERMS OF SUBSCRIPTION.

For the current year 1885–86, $1.
For the year 1884–85 (134 pp. in cloth covers), $1.50.
For the year 1883–84 (140 pp. in cloth covers), $1.50.
For the year 1882–83 (156 pp. in cloth covers), $3.00.
For the years 1879–82 (250 pp. in cloth covers), $5.00.

Subscribers to the Circulars will also receive the Annual Register and Report of the University.

All subscriptions should be addressed to the Publication Agency of the Johns Hopkins University.

Communications for the Circulars should be sent in prior to the first day of the month in which they are expected to appear.

UNIVERSITY CALENDAR, 1886-87.

The tenth academic year closed Tuesday, June 15, 1886.

The eleventh academic year begins on Friday, October 1, 1886, and continues till June 15, 1887.

The Autumn Examinations for Admission will begin Friday, October 1, at 9 a. m.

There will be a Christmas Recess, beginning on Friday, December 24, and ending on Monday, January 3;—also a Spring Recess, beginning on Friday, April 8.

INFORMATION FOR APPLICANTS FOR ADMISSION TO THE UNIVERSITY.

Printed in response to Letters.

GENERAL STATEMENTS.

How was the University founded?

The Johns Hopkins University was instituted by the munificence of a citizen of Baltimore, Johns Hopkins, who bequeathed the most of his large estate for the establishment of a University and a Hospital. The foundation of the University is a capital, in land and stocks, estimated in value at more than three million dollars; the capital of the Hospital is not less in amount. The University was incorporated under the laws of the State of Maryland, August 24, 1867, and it was opened for instruction in September, 1876. The Philosophical Faculty (of Letters and Science) is now organized. The organization of the medical department has been begun.

In what is instruction given?

Systematic instruction is offered in English, Anglo-Saxon, German, French, Italian, Spanish, Latin, Greek, Sanskrit, Hebrew, Arabic, and in other languages and literatures; in Pure and Applied Mathematics; in Chemistry, (Inorganic and Organic) with laboratory work; in Physics, (including Mechanics, Light, Heat, Sound, Electricity, Magnetism, etc.) with laboratory work; in Biology, (including Physiology and Morphology) with laboratory work; in Pathology; in Mineralogy and Geology; in Ancient and Modern History; in Physical Geography; in Political Economy and in the elements of International Law; in Logic, Ethics, Psychology, Pedagogics, etc. Occasional courses of lectures are also given upon special themes in Literature, Science, History, Archæology, Art, etc.

To whom is this instruction offered?

To all young men who are prepared to profit by it and who will conform to the simple regulations which are established by the authorities. Graduate, Undergraduate, and Special Students are received.

Those who have not already received an academic degree, should aim to secure one by pursuing a liberal and prolonged course of study, at the close of which the degree of Bachelor of Arts will be conferred. Those who may be prevented from seeking this degree, will nevertheless be welcomed to the University, provided that they are in earnest and are mature enough in years, attainments, and character to profit by the advantages which are here afforded. Others who have already taken their first degree are encouraged to go forward in advanced lines of work, and for them unusual facilities are provided. Young men who are to pursue the study of Law, Medicine, or Theology, or who have entered upon professional lives, and others who expect to become teachers, if they desire to increase their knowledge of literature and science, have easy access to the class-rooms and laboratories. The degree of Doctor of Philosophy may be obtained, after three years of advanced study, by those who have met the required conditions.

How is this instruction given?

By all the methods which experience has shown to be useful,—varying according to the preferences of the teachers, the subjects taught, and the number of scholars. There are recitations, lectures, conferences, prolonged courses in laboratories, exercises in special libraries, personal counsel, study of nature out-of-doors. The usual four-year classes are not maintained, but in all the principal subjects taught, there are beginners, intermediate students, and advanced workers; so that every scholar is assigned to that position in each section of the university which will yield him the greatest advantages. He may be far advanced in one subject and only a beginner in another. This result is only secured by the engagement of a large staff of teachers.

What are the Laboratory and Library Facilities?

The scientific laboratories are three in number. They are open throughout the day and are fully equipped. For Chemistry, there is a special building arranged for about ninety workers, and well adapted to all kinds of chemical and mineralogical work. A large building has been constructed for a Biological Laboratory, with complete arrangements for physiological and morphological work. The Physical Department is furnished with apparatus selected both for demonstration and investigation, and especially valuable for researches in electricity, magnetism, light, and heat. The construction of a new building for the Physical Laboratory is now in progress.

The Library includes over twenty-nine thousand bound volumes, and eight hundred serials are regularly received. It is open thirteen hours daily. The Library of the Peabody Institute, with eighty-six thousand volumes, and the other Baltimore libraries are of easy access. Washington is so near that the Library of Congress, the National Museum, and the other libraries and museums of the capital may be readily visited.

What are the necessary expenses of a Student?

The charge for tuition in all departments, (including the use of the library, and without any extra charges except twenty dollars for materials consumed in the laboratories), is one hundred dollars per annum, payable one-half October 1, and the other half February 1.

Young men living in any part of Baltimore, or in the immediate vicinity, can lodge at home, as the first lessons are given at nine a. m. daily, and there is rarely any required exercise as late as five p. m. Young men from a distance can readily find rooms and good board either in private dwellings or in boarding houses. It is possible to secure accommodations (room and board) for five or six dollars per week, and for a sum between six and ten dollars per week it is still easier to be suited. The other necessary expenses of life are moderate.

Are there any scholarships?

In accordance with the request of the founder of the University, twenty Hopkins Scholarships, giving free tuition, are open to matriculated undergraduate students from Maryland, Virginia, and North Carolina. In addition to these, there are eighteen Honorary Hopkins Scholarships, yielding two hundred and fifty dollars and free tuition, also open to matriculated undergraduate students from the three States named. Of these thirty-eight scholarships, ten are open to students at the beginning of the college course; fourteen (of which nine are Honorary) at the close of the first year; and fourteen again (of which nine are Honorary) at the close of the second year, tenable in all cases for the year subsequent to the appointment. For further information, consult the Register where the conditions of appointment are fully stated.

GRADUATE COURSES.

What special opportunities are offered to University Students?

Advanced and graduate students are received with or without reference to their being candidates for a degree, and they are permitted to attend such lectures and exercises as they may select. They are not examined for admission to the University, but each instructor satisfies himself of the attainments of all who wish to follow his guidance before admitting them to his classes.

Systematic courses of instruction, varying every year, are announced in the annual programme. The professors are free to give personal counsel and instruction to those who seek it; books and instruments adapted to investigation and advanced work have been liberally provided; the system of Fellowships secures the presence of twenty special students imbued with the university spirit, most of them looking forward to academic careers; seminaries limited to a few advanced students under the guidance of a director have been organized in various subjects; societies devoted to Philology, to Mathematical, Physical, and Natural Science, to Metaphysics, to History and Political Science, and to Archæology, afford opportunities for the presentation of memoirs and original communications, and there are also clubs for the reading and discussion of biological, physical, and chemical papers; during the year, courses of lectures are given by resident and non-resident professors on topics to which they have given special attention; the libraries of the Peabody Institute and Maryland Historical Society, founded for the advantage of scholars, are easily accessible; the issuing under the auspices of the Trustees, of publications devoted to Mathematics, Chemistry, Philology, Biology, and History, brings the University into advantageous connection with other foundations; special libraries connected with the seminaries bring the most important works within easy reach of the student, and the University reading-room, which is constantly open, is liberally supplied with new and with standard books and with the literary and scientific journals of this and other lands.

On What conditions is the Degree of Doctor of Philosophy conferred?

The degree of Doctor of Philosophy and Master of Arts is conferred upon candidates who (after having taken their first degree) have pursued university studies, for three years, under approved conditions, have passed the required examinations and presented a satisfactory thesis. At least the last year of study must be spent in this University.

How are the Fellowships awarded?

Twenty fellowships are annually open to competition, each yielding five hundred dollars and exempting the holder from all charges for tuition. A statement of the rules governing the awards will be sent if requested. Applications for the next year must reach the University before May 1, 1887.

COLLEGE COURSES.

Is there what is commonly known as a college course?

There are seven parallel courses, by following any one of which a matriculated student may attain the degree of Bachelor of Arts. This plan combines the advantages of choice and restriction. From the variety of courses laid down, the scholar elects that which he prefers; having made his choice he finds a definite sequence of studies provided for him. The University marks out for those who elect a classical course, such a plan for the reading of Latin and Greek authors, sometimes with a teacher and sometimes privately, as will enable all who follow it to excel in these studies, while it requires that they should also learn to read French and German, and pursue during one year a course in science. It likewise provides a training which is mainly scientific, enabling the student to concentrate his attention chiefly on Chemistry, or Biology, or Mathematics, or Physics; but with these studies he must combine the study of Languages, History, and Philosophy.

Every matriculated student is expected to follow, under the guidance of an adviser to whom he is specially assigned, one of these prescribed courses which are fully described in the Register. Some elect the classical course. Others may concentrate their main attention upon the higher branches of Mathematics. Courses are arranged also for those who wish to devote themselves chiefly to Chemistry and Physics. For those who expect at a later day to take up the study of medicine, there is a special course marked out, in which Biology is the dominant subject. Arrangements are also made in other courses for the study of History and Political Science and of the Modern Languages and Literatures.

What is required for admission to the College Courses?

Undergraduates who wish to enter, either as matriculates, candidates for matriculation, students in the preliminary medical course, or as special students, must begin by satisfying the University that they have been thoroughly taught the English studies which are usual in good high schools, academies, and private schools, including a knowledge of Arithmetic (with the metric system); Geography, physical and political; the outlines of the History of the United States; English grammar and composition. The candidate for matriculation must also pass an examination in:—

1, Latin; 2, Greek, (or French and German); 3, Mathematics (Algebra, Geometry, Trigonometry, Analytical Geometry); 4, English; 5, History; 6, Natural Science. Those who do not intend to follow the classical course may offer French and German instead of Greek.

Can a student be aided in completing his studies for matriculation?

If a student at his admission passes in a considerable part of the matriculation requirements, he may postpone the remainder for a time. If he is well up in Algebra and Geometry, he may join the university classes in Trigonometry and Analytical Geometry; if he is a good scholar in Latin and Greek but has not read all the authors requisite for matriculation, he may receive instruction in these authors from the University; if he has not already acquired the elements of French and German, he will be aided in doing so, in order that he may enter the courses here provided.

A student may also pass a part of the matriculation examination one year before his admission to the University and receive, under certain conditions, credit for the same.

When will the next examinations be held?

Examinations for admission will begin Friday, October 1, at nine a. m. Those who pass the preliminary examination in English studies acceptably will be subsequently examined in such of the other studies as they are ready to offer.

For further information consult the Annual Register of the University for 1885-86.

PUBLICATIONS ISSUED UNDER THE AUSPICES OF THE UNIVERSITY.

I. American Journal of Mathematics.

The publication of this journal commenced in 1878, under the editorial direction of Professor Sylvester. It is now conducted by Professor Simon Newcomb, as Editor, and Dr. T. Craig, as Associate Editor. Seven volumes of about 400 pages each have been issued and the eighth is in progress. It appears quarterly, in the quarto form. Subscription $5 per year. Single numbers $1.50.

II. American Chemical Journal.

This journal was commenced in 1879, with Professor Remsen as Editor. Seven volumes of about 450 pages each have been issued and the eighth is in progress. It appears bi-monthly. Subscription $3 per year. Single numbers 50 cents.

III. American Journal of Philology.

The publication of this journal commenced in 1880, under the editorial direction of Professor Gildersleeve. Six volumes of about 570 pages each have been issued, and the seventh is in progress. It appears four times yearly. Subscription $3 per volume. Single numbers $1.00.

IV. Studies from the Biological Laboratory.

(Including the Chesapeake Zoölogical Laboratory.)

The publication of these papers commenced in 1879, under the direction of Professor Martin, with the assistance of Dr. W. K. Brooks. Two volumes of about 500 pages octavo, and 40 plates each, have been issued, and the third is in progress. Subscription $5.00 per volume.

V. Studies in Historical and Political Science.

The publication of these papers was begun in 1882, under the editorial direction of Dr. H. B. Adams. A first series of 470 pages, a second of 630 pages and a third series of 595 pages are now completed, and a fourth series is in progress. Subscription $3 per volume.

VI. Johns Hopkins University Circulars.

The publication of the Circulars began in December, 1879, and fifty numbers have since been issued. Subscription $1 per year. Subscribers to the Circulars will also receive the Annual Register and the Annual Report of the University.

VII. Annual Report.

Presented by the President to the Board of Trustees, reviewing the operations of the University during the past academic year.

VIII. Annual Register.

Giving the list of the officers and students, and containing detailed statements as to the regulations and work of the University.

Announcements of proposed lectures, courses of instruction, etc., appear in the University Circulars, or are separately issued as Programmes from time to time.

During the year 1885–86, in addition to the current journals named above, there have been issued by the University:

Photograph of the Normal Solar Spectrum. Made by Professor H. A. Rowland. Set of seven plates unmounted $10, mounted $12; single plates unmounted $2, mounted $2.25.

Reproduction in Phototype of a Syriac MS. with the Antilegomena Epistles. (Including seventeen phototype pages, each on a separate leaf, besides additional pages containing descriptive and explanatory matter.) Edited by Dr. I. H. Hall. 250 copies. $3.

Communications in respect to exchanges and remittances may be sent to the Johns Hopkins University (Publication agency,) Baltimore, Maryland.

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